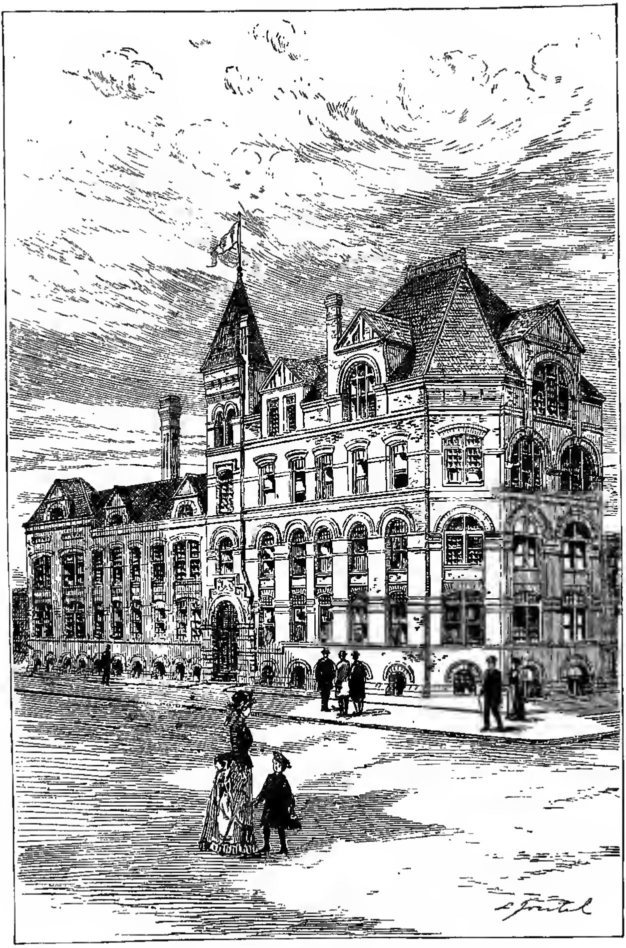
·MANUAL·TRAINING·

·CHARLES·M·HAM·



THE CHICAGO MANUAL TRAINING SCHOOL.

MANUAL TRAINING

THE SOLUTION OF
SOCIAL AND INDUSTRIAL PROBLEMS.

BY CHARLES H. HAM.

ILLUSTRATED BY FIFTEEN ENGRAVINGS ON WOOD.

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PREFACE.

In 1879 I read a paper before the Chicago Philosophical Society on the subject of "The Inventive Genius; or, an Epitome of Human Progress." The suggestion of the subject came from Mr. Charles J. Barnes, to whom I desire in this public way to express my obligation for an introduction to a profoundly interesting study, and one which has given a new direction to all my thoughts.

At the conclusion of my labors in the preparation of the paper, I realized the force of Bacon's remark, that "the real and legitimate goal of the sciences is the endowment of human life with new inventions and riches."

In tracing the course of invention and discovery, I found that I was moving in the line of the progress of civilizatiou. I found that the great gulf between the savage and the civilized man is spanned by the seven hand-tools—the axe, the saw, the plane, the hammer, the square, the chisel, and the file—and that the modern machine-shop is an aggregation of these tools driven by steam. I hence came to regard tools as the great civilizing agency of the world. With Carlyle I said, "Man without tools is nothing; with tools he is all." From this point it was only a step to the proposition that, It is through the arts alone that all branches of learning find expression, and touch human life. Then I said, The true definition of education is the development of all the powers of man to the culminating point of action; and this power in the concrete, the power to do some useful thing for man—this must be the last analysis of educational truth.

These ideas are not new. They pervade Lord Bacon's writings, are admirably formulated in Rousseau's "Emile," and were restated by Mr. Herbert Spencer twenty-five years ago. More than this, Comenius, Pestalozzi, and Froebel attempted to carry them into practical operation in the school-room, but with only a small measure of success. It remains for the age of steel to show how powerless mere words are in the presence of things, and so to emphasize the demand for a radical reform in educational methods.

In 1880 my attention was drawn to the Manual Training Department of the Washington University of St. Louis, Mo. In that school I found the realization of Bacon's aphorism, "Education is the cultivation of a just and legitimate familiarity betwixt the mind and things." I made an exhaustive study of the methods of the St. Louis school, and reached the conclusion that the philosopher's stone in education had been discovered. The columns of the *Chicago Tribune* were opened to me, and I wrote constantly on the subject for the ensuing three years. Meantime the Chicago Manual Training School (the first independent institution of the kind in the world) was founded and opened, and the agitation spread over the whole country, and indeed over the whole civilized world.

This work was commenced two years ago. I found the labor much more arduous than I anticipated, and its completion has hence been delayed far beyond the time originally contemplated for placing it in the hands of a publisher. It may be summarized briefly as consisting of four divisions: 1. A detailed description of the various laboratory class processes, from the first lesson to the last, in the course of three years. 2. An exhaustive argument *a posteriori* and *a fortiori* in support of the proposition that tool practice is highly promotive of intellectual growth, and in a still greater degree of the upbuilding of character. 3. A sketch of the historical period, showing that the decay of civilization and the destruction of social organisms have resulted directly from defects in methods of education. 4. A brief sketch of the history of manual training as an educational force.

To Dr. John D. Runkle, of the Massachusetts Institute of Technology, the founder of manual training as an educational institution in this country, I cannot express too strongly my deep obligation for valuable suggestions and constant encouragement. To him also am I indebted for nearly all my illustrations, as also particularly for the excellent portrait of M. Victor Della Vos, the founder of the new system of education in Russia. I am also under obligations to Col. Augustus Jacobson, a leading advocate of the new education, for constant counsel and support, as also to Dr. Henry H. Belfield, Director of the Chicago Manual Training School, and Mr. John S. Clark, of Boston.

Of the authors consulted, I cannot forbear mention of Lord Bacon, Rousseau, and Herbert Spencer, whose great works constitute the foundation of the new system of education according to nature. Nor can I omit to acknowledge, with all the emphasis of which words are susceptible, my obligations to Mr. Samuel Smiles. His works, from the lives of the engineers to the shortest of his biographies, constitute an inexhaustible treasure-house of facts from which I have drawn without stint. Mr. Smiles has traced the springs of English greatness to their true source, the workshop. I have attempted to continue his office by showing that the workshop is a great educational force, and hence that its educational element ought to be incorporated in the system of public instruction.

The propositions of the following pages involve an educational revolution destined to enlighten, and so ultimately to redeem manual labor from the scorn of the ages of slavery, and, in the end, to render the skilled laborer worthy of high social distinction, thus presenting at once a solution not only of the industrial question but of the social question.

CHARLES H. HAM.

CONTENTS.

CHAPTER V.

THE CARPENTER'S LABORATORY.

CHAPTER VI.

THE WOOD-TURNING LABORATORY.

CHAPTER VII.

THE FOUNDING LABORATORY.

CHAPTER VIII.

THE FORGING LABORATORY.

CHAPTER IX.

THE MACHINE-TOOL LABORATORY.

CHAPTER X.

MANUAL AND MENTAL TRAINING COMBINED.

CHAPTER XIV.

THE MIND AND THE HAND.

CHAPTER XV.

THE POWER OF THE TRAINED HAND.

CHAPTER XVI.

THE INVENTORS, CIVIL ENGINEERS, AND MECHANICS OF ENGLAND, AND ENGLISH PROGRESS.

CHAPTER XIX.

AUTOMATIC CONTRASTED WITH SCIENTIFIC EDUCATION—*Continued.*

CHAPTER XX.

AUTOMATIC CONTRASTED WITH SCIENTIFIC EDUCATION—*Continued.*

CHAPTER XXI.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

EGYPT AND GREECE.

CHAPTER XXII.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

ROME.

CHAPTER XXIII.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

THE MIDDLE AGES.

CHAPTER XXIV.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

EUROPE.

CHAPTER XXV.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

AMERICA.

CHAPTER XXVI.

HISTORY OF THE MANUAL ELEMENT IN EDUCATION.

ILLUSTRATIONS.

POWER.

"*His tongue was framed to music,*
And his hand was armed with skill;
His face was the mould of beauty,
And his heart the throne of will."

EMERSON.

MANUAL TRAINING.

CHAPTER I.

THE CHICAGO MANUAL TRAINING SCHOOL.

Its Situation on the Boulevard.—Its Tall Chimney.—The Whir of Machinery and Sound of the Sledge-hammer.—The School that is to dignify Labor.—The Realization of the Dream of Bacon, Rousseau, Comenius, Pestalozzi, and Froebel.—Established by the Commercial Club.—The School that fitly represents the Age of Steel.

In a conspicuous place on the principal boulevard in the city of Chicago is situated the fine brick building, a picture of which constitutes the frontispiece of this book. It occupies an angle formed by the intersection of two streets, and consists of four stories and basement. All the walls are thickly pierced with windows, affording abundant light for the interior, and a tall chimney rises above the roof. Smoke issues from the chimney-stack, and the hum and whir of machinery is heard, and the heavy thud of the sledge-hammer resounding on the anvil smites the ear. Up and down the boulevard, as far as the eye can reach, stretch miles of brick, stone, and marble dwellings; and to the north-east, through the branches of wide-spreading elms, there is a view of the great inland sea on whose bosom floats the commerce of an empire.

Has the secret of making diamonds been discovered, and is this the inventor's factory?

No. This is a school; the school of the future; the school that is to dignify labor; the school that is to generate power; the school where every sound contributes to the harmony of development, where the brain informs the muscle, where thought directs every blow, where the mind, the eye, and the hand constitute an invincible triple alliance. This is the school that Locke dreamed of, that Bacon wished for, that Rousseau described, and that Comenius, Pestalozzi, and Froebel struggled in vain to establish.

It is, then, a diamond factory after all. For if it be, as claimed, the true school, it is destined to lift the veil from the face of Nature, to reveal her most precious secrets, and to divert to man's use all her treasures.

Yes; it is to other schools what the diamond is to other precious stones—the last analysis of educational thought. It is the philosopher's stone in education; the incarnated dream of the alchemist, which dissolved earth, air, and water into their original elements, and recombined them to compass man's immortality. Through it that which has hitherto been impossible is to be rendered possible.

Is it a public school?

Yes and no. Yes in this sense—that it is founded for the public benefit; no in this sense—that it is not supported from the public revenue. It is placed conspicuously and amid pleasant surroundings, that it may be in the public eye a living fountain whence the propaganda of the new educational evangel shall promulgate its doctrines and send forth its missionaries.

Who established it?

The Commercial Club, an association consisting of sixty Chicago merchants. Their purpose in founding the school was industrial, not educational reform. Being men of large experience in practical affairs they realized that the destruction of the apprentice system would tend to a decline of American industrial power, hence they instituted an inquiry on the subject, "How to increase the supply of skilled labor?" Several invited guests of the club took part in the discussion of the subject on an evening designated for the purpose. The discussion was carried beyond the purely industrial scope of the question submitted, into the domain of education, and a degree of interest was manifested in manual training, the existence of which had not been even suspected by the most ardent friends of educational reform. Before the club adjourned, its members had pledged themselves to found a manual training school, and guaranteed for its construction, equipment, and support the sum of one hundred thousand dollars. But in founding this school to secure better mechanics—more skilful workers in wood and iron—they "builded better than they knew," for they unconsciously inaugurated an educational revolution. In laying the foundations of education in labor it is dignified and education is ennobled. In such a union there is honor and strength, and long life to our institutions. For the permanence of the civil compact in this country, as in other countries, depends less upon a wide diffusion of unassimilated and undigested intelligence than upon such a thorough, practical education of the masses in the arts and sciences as shall enable them to secure, and qualify them to store up, a fair share of the aggregate produce of labor.

If this school shall appear like a hive of industry, let the reader not be deceived. Its main purpose, intellectual development, is never lost sight of for a moment. It is a system of object-teaching—teaching through things instead of through signs of things. It is the embodiment of Bacon's aphorism—"Education is the cultivation of a just and legitimate familiarity betwixt the mind and things." The students draw pictures of things, and then fashion them into things at the forge, the bench, and the turning-lathe; not mainly that they may enter machine-shops, and with greater facility make similar things, but that they may become stronger intellectually and morally; that they may attain a wider range of mental vision, a more varied power of expression, and so be better able to solve the problems of life when they shall enter upon the stage of practical activity.

It is a theory of this school that in the processes of education the idea should never be isolated from the object it represents; (1) because the idea, being the reflex perception or shadow of the object, is less clearly defined than the object itself, and (2) because joining the object and the idea intensifies the impression. Separated from its object the idea is unreal, a phantom. The object is the flesh, blood, bones, and nerves of the idea. Without its body the idea is as impotent as the steam that rises from the surface of boiling water and loses itself in the air. But unite it to its object and it becomes the vital spark, the animating force, the Promethean fire. Thus steam converts the Corliss engine—a huge mass of lifeless iron—into a thing of grace, of beauty, and of resistless power. Suppose the teacher, for example, desires to convey to the mind of a child having no knowledge of form an impression of the shape of the earth; he says, "It is globular." The child's face expresses nothing because there is in its mind no conception of the object represented by the word globular. The teacher says, "It is a sphere," with no better success. He adds, "A sphere is a body bounded by a surface, every point of which is equally distant from a point within called the centre." The child's face is still expressionless. The teacher takes a handful of moist clay and moulds it into the form of a sphere, and exhibiting it, says, "The earth is like this." The child claps its hands, utters a cry of delight, and exclaims, "It is round like a ball!"

This is an illustration of the triumph of object-teaching, the method alike of the kindergarten and the manual training school. As the child is father of the man, so the kindergarten is father of the manual training school. The kindergarten comes first in the order of development, and leads logically to the manual training school. The same principle underlies both. In both it is sought to generate power by dealing with things in connection with ideas. Both have common methods of instruction, and they should be adapted to the whole period of school life, and applied to all schools.

This school, situated on one of the most beautiful streets in the world, in the city most precisely representative of the present age—the age of steel—is dedicated to manual education, to the generation of power, to the development of true manhood. And above all, this school is destined to unite in indissoluble bonds science and art, and so to confer upon labor the highest and justest dignity. The reason of the degradation of labor was admirably stated by America's most distinguished educational reformer, the late Mr. Horace Mann, who said, "The labor of the world has been performed by ignorant men, by classes doomed to ignorance from sire to son; by the bondmen and bondwomen of the Jews, by the helots of Sparta, by the captives who passed under the Roman yoke, and by the villeins and serfs and slaves of more modern times."

When it shall have been demonstrated that the highest degree of education results from combining manual with intellectual training, the laborer will feel the pride of a genuine triumph; for the consciousness that every thought-impelled blow educates him, and so raises him in the scale of manhood, will nerve his arm, and fire his brain with hope and courage.

CHAPTER II.

THE MAJESTY OF TOOLS.

Tools the Highest Text-books—How to Use them the Test of Scholarship—They are the Gauge of Civilization—Carlyle's Apostrophe to them.—The Typical Hand-tools.—The Automata of the Machine-shop.—Through Tools Science and Art are United.—The Power of Tools—Their Educational Value.—Without Tools Man is Nothing; with Tools he is All.—It is through the Arts alone that Education touches Human Life.

Sacred to the majesty of tools might be appropriately inscribed over the entrance to this school for manual education; for its highest text-books are tools, and how to use them most intelligently is the test of scholarship. To realize the potency of tools it is only necessary to contrast the two states of man—the one without tools, the other with tools. See him in the first state, naked, shivering with cold, now hiding away from the beasts in caves, and now, famished and despairing, gaunt and hollow-eyed, creeping stealthily like a panther upon his prey. Then see him in the poetic, graphic apostrophe of Carlyle. "Man," he says, "is a tool-using animal. He can use tools, can devise tools; with these the granite mountains melt into light dust before him; he kneads iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing, with tools he is all!"

What a picture of the influence of tools upon civilization! It is through the use of tools that man has reached the place of absolute supremacy among animals. As he increases his stock of tools he recedes from the state of savagery. The great gulf between the aboriginal savage and the civilized man is spanned by the seven hand-tools—the axe, the saw, the plane, the hammer, the square, the chisel, and the file. These are the universal tools of the arts, and the modern machine-shop is an aggregation of them rendered automatic and driven by steam.

The ancients constructed automata which were exceedingly ingenious. In the statues that could walk and talk, the Chinese puppets and the marionettes of the Greeks there was a hint of the modern automatic tools, which, driven by steam, fashion with equal accuracy the delicate parts of the watch and the huge segments of the marine engine. The ancients knew more of science than of art. They were familiar with the power of steam, but knew not how to apply it to the wants of man. They knew that steam would turn a spit, but they had not a sufficient knowledge of art to convert the power they had discovered into a monster of force, and train it to bear the burdens of commerce. They never thought to apply the jet of steam used to turn a spit to great automatic machines, and to fit into them saws and files, and needles and drills, and gimlets and planes, and compel them to do the work of thousands of men. But this is precisely what the modern mechanic has accomplished. In making a slave of steam, science and art have combined to free mankind.

We marvel at the dulness of the ancients as shown in their failure to utilize in the practical arts the discoveries of science. That they should have studied the stars over their heads to the neglect of the earth under their feet is incomprehensible to the modern mind. But will not future generations marvel at us? Is it not an astounding fact that, with a knowledge of the tremendous influence of tools upon the destiny of the human race so graphically depicted by Carlyle, the nations have been so slow in incorporating tool-practice into educational methods? The distinguishing features of modern civilization sprang as definitively from cunningly devised and skilfully handled tools as any effect from its cause. And yet the world's statesmen have failed to discover the value of tool-practice as an educational agency. The face of the globe has been transformed by the union of art and science, but the world's statesmen have not discerned the importance of uniting them in the curriculum of the schools. If the ancients could see us as we see them, they would doubtless laugh at us as we laugh at them.

We might take a lesson from the savage. He is taught to fight, to hunt, and to fish, and in these arts the brain, the hand, and the eye are trained simultaneously. He is first given object-lessons, as the pupil of the kindergarten is taught. Then the tomahawk, the spear, and the bow and arrow are placed in his hands, and he fights for his life, or fishes or hunts for his dinner. The young Indian is taught all that it is necessary for him to know, and he is educated, practically, in the savage's three workshops—the battle-field, the forest and plain, the sea and lake. Thus the young savage enters upon the duties of his life with an exact practical knowledge of them. He has not been taught a theory of fighting, he has used the weapons of warfare; he has not studied the arts of fishing and hunting, he has handled the spear and the bow and arrow, and their use is as familiar to him as the multiplication table is to the boy in the public school.

We have more and better tools than the savage possesses. With the aid of science and these tools we harness steam to our chariot and compel it to draw us whither we will. We steal fire from the clouds and make it serve us as a messenger. We imprison the air, and with it stop the flying railway train. With the aid of science and these tools we reduce the most subtile forces of nature to servitude, but we neither teach our youth how to master their elements nor how to use them.

Tools represent the steps of human progress—in architecture, from the mud hut to the modern mansion; in agriculture, from the pointed stick used to tear the turf to a thousand and one ingenious instruments of husbandry; in ship-building, from the rudderless, sailless boat to the ocean steamer; in fabrics, from the matted fleece of the shepherd to the varied products of countless looms; in pottery, from the first rude Egyptian cup to the exquisite vase of the Sevres factory. And so of every art that contributes to the comfort and pleasure of man; the development of each has been accomplished by tools in the hands of the laborer.

Since, then, man owes so much to labor, he has doubtless educated the laborer and showered honors upon him (?). On the contrary, the labor of the world has been performed by the most ignorant classes, by bondmen, by helots and captives, by serfs and slaves. The laborer has been held in such contempt, and been so debased by ignorance, that he has often violently protested against improvements in the tools of the trades, and with vandal hands destroyed the mill, the factory, and the forge erected to ameliorate his condition. At the top of the social scale the sage has studied the stars and invented systems of abstract philosophy; at the bottom ignorance has deified itself and starved. This divorce of science from art has resulted in such incongruities as the Pyramids of Egypt and periodical famines; as the hanging gardens of Babylon and the horrors of Jewish captivity; as the Greek Parthenon and dwellings without chimneys; as the statues of Phidias and Praxiteles, and royal banquets without knives, forks, or spoons; as the Roman Forum and the Roman populace crying for bread and circuses; as Socrates, Plato, Seneca and Aurelius, and Caligula, Claudius, Nero and Domitian.

On the other hand the union of science with art tunnels the mountain, bridges the river, dams the torrent, and converts the wilderness into a fruitful field.

Science discovers and art appropriates and utilizes; and as science is helpless without the aid of art, so art is dead without the help of tools. Tools then constitute the great civilizing agency of the world; for civilization is the art of rendering life agreeable. The savage may own a continent, but if he possesses only the savage's tools—the spear and the bow and arrow—he will be ill-fed, ill-housed, ill-clothed, and poorly protected both against cold and heat. He might be familiar with all the known sciences, but if he were ignorant of the arts his state, instead of being improved, would be rendered more deplorable; for with the thoughts, emotions, sensibilities, and aspirations of a sage he would still be powerless to steal from heaven a single spark of fire with which to warm his miserable hut.

In the light of this analysis Carlyle's rhapsody on tools becomes a prosaic fact, and his conclusion—that man without tools is nothing, with tools all—points the way to the discovery of the philosopher's stone in education. For if man without tools is nothing, to be unable to use tools is to be destitute of power; and if man with tools is all, to be able to use tools is to be all-powerful. And this power in the concrete, the power to do some useful thing for mankind—this is the last analysis of educational truth.

There is no better definition of education than that of Pestalozzi—"the generation of power." But what kind of power? Not merely power to think abstractly, to speculate, to moralize, to philosophize, but power to act intelligently. And the power to act intelligently involves the exertion, in greater or less degree, of all the powers, both mental and physical. Education, then, is the development of all the powers of man to the culminating point of action. What kind of action? Action in art. What is art? "The power of doing something not taught by nature or instinct; power or skill in the use of knowledge; the practical application of the rules or principles of science." Again we have the last analysis of education—"skill in the use of knowledge; the application of the rules or principles of science." And this is tool practice.

It is unnecessary, in an educational view, to divide the arts by the use of the terms "practical" and "fine;" for the fine arts can only exist legitimately where the practical arts have paved the way. In a harmonious development the artist will enter on the heels of the artisan. Art is cosmopolitan. It is not less worthily represented by the carpenter with his square, saw, and plane, and the smith with his sledge, than by the sculptor with his mallet and chisel, and the painter with his easel and brush. Both classes contribute to the comfort and pleasure of mankind; for comfort is enhanced by pleasure, and pleasure is intensified by comfort. It follows that the ultimate object of education is the attainment of skill in the arts. To this end the speculations and investigations of philosophy and the experiments of chemistry lead. At the door of the study of the philosopher and of the laboratory of the chemist stands the artisan, listening for the newest hint that philosophy can impart, waiting for the result of the latest chemical analysis. In his hands these suggestions take form; through his skilful manipulation the faint indications of science become real things, suited to the exigencies of human life.

It is the most astounding fact of history that education has been confined to abstractions. The schools have taught history, mathematics, language and literature and the sciences, to the utter exclusion of the arts, notwithstanding the obvious fact that it is through the arts alone that other branches of learning touch human life. As Bacon has so aptly expressed it, "The real and legitimate goal of the sciences is the endowment of human life with new inventions and riches." In a word, public education stops at the exact point where it should begin to apply the theories it has imparted. At this point the school of manual training begins; not only books but tools are put into the hands of the pupil, with this injunction of Comenius: "Let those things that have to be done be learned by doing them."

CHAPTER III.

THE ENGINE-ROOM.

The Corliss Engine—A Thing of Grace and Power—The Growth of Two Thousand Years—From Hero to Watt—Its Duty as a School-master.—The Interdependence of the Ages.—The School in Epitome.

Let us enter the Manual Training School building and take a bird's-eye view of the visible processes of the new education.

The first object that attracts attention is the engine. It is a "Corliss," fifty-two horse-power, and makes that peculiar kind of noise which conveys to the mind of the observer an impression of restrained power. When the student, upon entering the school, is shown this beautiful machine he is told that it, like all other inventions, is a growth—the growth of at least two thousand years; that the power of steam was known to the ancients—the Egyptians, Greeks, and Romans; that Hero, a philosopher of Alexandria, invented a crude steam-engine before the beginning of the Christian era, and that the engine before us, which throbs and trembles under the pressure of its battery of steel boilers in doing duty as a school-master, is the latest development of Hero's conception. The educational idea underlying this fact is the interdependence of the ages; each generation is a link between the past and the future. "To show," as Philarète Chasles says, "that man can only act efficiently by association with others, it has been ordained that each inventor shall only interpret the first word of the problem he sets himself to solve, and that every great idea shall be the *résumé* of the past at the same time that it is the germ of the future."

The first word of the solution of the steam-power problem came from Hero down the ages, through Decaus, Papin, Savory, Newcomen, Breighton, and Smeaton, to Watt. To Watt is awarded the honor of the invention of the modern steam-engine; but the first conception of his engine was derived from an atmospheric machine through the accident of it having been placed in his hands for repairs. Smeaton was the inventor of that atmospheric engine, and his mind was one of the links in the chain of intelligences extending back to Egypt, through whose united agency the steam-engine became a real thing of power in the cunning hands of James Watt, of whom the late Dr. Draper said, "He conferred on his native country more solid benefits than all the treaties she ever made and all the battles she ever won." This law governing great achievements is full of encouragement to the student of mechanics, for while the thought of compassing any great discovery or invention may well appall even the boldest, the most humble may hope through studious industry to contribute something to the sum of human knowledge.

The engine-room of our school is neater than that of the ordinary machine-shop, but the furnace roars like any other, its open mouth shows a bank of glowing coals, and the "stoker," with grimy hands, wipes the sweat from his sooty brow. The whole school is here seen in epitome: the "stoker" typifies the student toiling at the forge, and in the polished engine, exhibiting both grace and power in its automatic action, we see the student's graduating project, a machine, the joint creation of brain, eye, and hand.

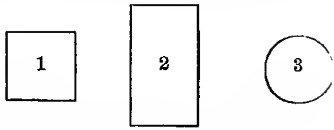
CHAPTER IV.

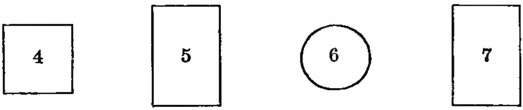
THE DRAWING-ROOM.

Twenty-four Boys bending over the Drawing-board.—Analysis and Synthesis in Drawing.—Geometric Drawing.—Pictorial Drawing. —The Principles of Design.—The Æsthetic in Art.—The Fundamentals—Object and Constructive Drawing.—Drawing for the Exercises in the Laboratories.—The Educational Value of Drawing—The Language of Drawing.—Every Student an expert Draughtsman at the end of the Course.

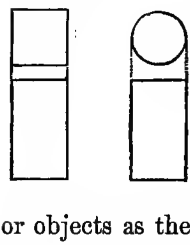
PASSING from the engine-room in the basement to the second story we enter the room assigned to drawing, where twenty-four boys are bending over the drawing-board, pencil in hand. Every school-day for three years these boys will spend an hour in this room. Each division of drawing—free-hand and mechanical—is thoroughly taught. Every graduate of the institution will be an expert draughtsman. The room is very still, only the scratching sound of twenty-four pencils is heard. The instructor moves about among the students, with here and there a hint, a suggestion, a correction, or a word of commendation—"good."

Drawing is the representation on paper of the facts, and the appearance to the eye of forms. The exercise proceeds by both analysis and synthesis. A cube is divided into all the geometric figures of which it is susceptible, and these figures are imitated with the pencil on paper. Then the figures are reunited, and the cube is similarly imitated. As the child in the kindergarten is taught several fundamental geometric facts through the use of variously subdivided cubes, so the student of drawing is taught by a similar process how to represent these fundamental facts on paper. For example (1), the student is taught to draw the following (sketches 1, 2, and 3) geometric forms of the square, oblong, and circle; (2) he is taught (sketches 4, 5, 6, and 7) to represent the facts of the oblong block and cylinder; (3) these facts are expressed as follows (sketches 8 and 9) in working

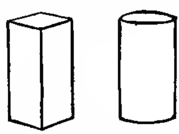




drawings. Sketches 8 and 9 are such drawings as would be placed in the hands of a mechanic as plans for the manufacture of the solids they represent; and the most elaborate working drawings for building and mechanical purposes are merely the complete development of this division of the art.



Another division of drawing consists in the representation of solids or objects as they appear to the eye or pictorially. The oblong block and cylinder, for example, appear to the eye very differently from their facts represented in the working drawings (sketches 8 and 9), as thus—



The development of this division of drawing leads to general pictorial representation.

Finally the mastery of the art of drawing involves a study of the principles of design as applied to industrial articles with the purpose of enhancing their value, as designs for wall-paper, carpets, embroideries, tapestry, textiles generally, and decorative work in wood. This is the æsthetic element in the art which appeals to and develops the student's taste. It is an important feature of drawing, not less on this account than from the fact that the designer's profession is a very lucrative one, but it is less important than object and constructive drawing, because less fundamental. Besides, object and constructive work in drawing come first in the order of development, and it is an inexorable rule of the new education to follow implicitly the hints of nature.

The basis of the art of drawing is geometry, and its *a*, *b*, *c* consists in a knowledge of certain geometrical lines, curves, and angles. This knowledge is gained from examples on the black-board which are reproduced on paper. But to relieve the student of this school from the tedium of reproducing, hundreds of times in succession, the same lines, angles, and curves, object-drawing is introduced very early in the course; and to render the exercise more attractive, as well as to impress it more firmly upon the mind, the objects drawn during the day are made features of the construction lesson in the carpenter's laboratory, the wood or iron turning laboratory, or the laboratory of founding on the following day. At first the objects selected for this exercise are of a very simple character, as a piece of plain moulding—a piece of elaborate moulding; parts of a drawing-board—an entire drawing-board; parts of a table or desk—an entire table or desk; parts of a draughtsman's stool—an entire stool; parts of a chair—an entire chair.

As the student advances in the general course he advances in object and constructive drawing, from simple to complex forms. He draws, for example, various parts of the steam-heating apparatus, and from these draughts makes working drawings of patterns for moulding. These he works out in the Carpenter's Laboratory, and thence takes them to the moulding-room, where they are used in the lesson given in moulding for casting. This method of instruction leads to a critical analysis of the entire interior of the school building. Each article is resolved into the original elements of its construction, and each element or part is first represented on paper, then expanded into working drawings, and then wrought out in wood and iron. Finally the student reaches the engine, every part of which is made the subject of exhaustive study; the facts of every part are represented on paper, working drawings of every part are made, and every part is reproduced in steel and iron in miniature, and, as a triumph of drawing, a representation on paper of the completed engine is produced.

The value of drawing as an educational agency is simply incalculable. It is the first step in manual training. It brings the eye and the mind into relations of the closest intimacy, and makes the hand the organ of both. It trains and develops the sense of form and proportion, renders the eye accurate in observation, and the hand cunning in execution.

The students are intent upon their work. The eye is busy acting as interpreter between the mind and the hand. Having conveyed the impression of an object to the mind, under its direction it now photographs the object on paper, and the hand obeying the will traces it out in lines. Thus the power is gained of multiplying forms of things with the pencil as words are multiplied by types.

Drawing is a language—the language in which art records the discoveries of science. It is not German, it is not French, it is not English—it is universal—common to all draughtsmen. The face of the student exhibits vivid flashes of intelligence as the picture reveals itself under his hand. Each line is a word, an angle completes the sentence; with a curve and a little delicate shading we have a paragraph. The picture begins to glow with thought. The student's face flushes, his heart beats quick and his hand trembles. But he restrains himself, and adds more lines, more angles and curves, more shading, and the picture is complete. It stands out in bold relief, and looks like a real thing. If the student knows the story of the brazen statue of Albertus Magnus he half expects his picture of a locomotive to move. He listens for the sound of the hissing steam, and a smile lights up his face as the illusion vanishes. Presently he will take his drawing to the shop, and at the bench, the lathe, the anvil, and the forge, reproduce it in iron and steel, and actually vitalize it with steam.

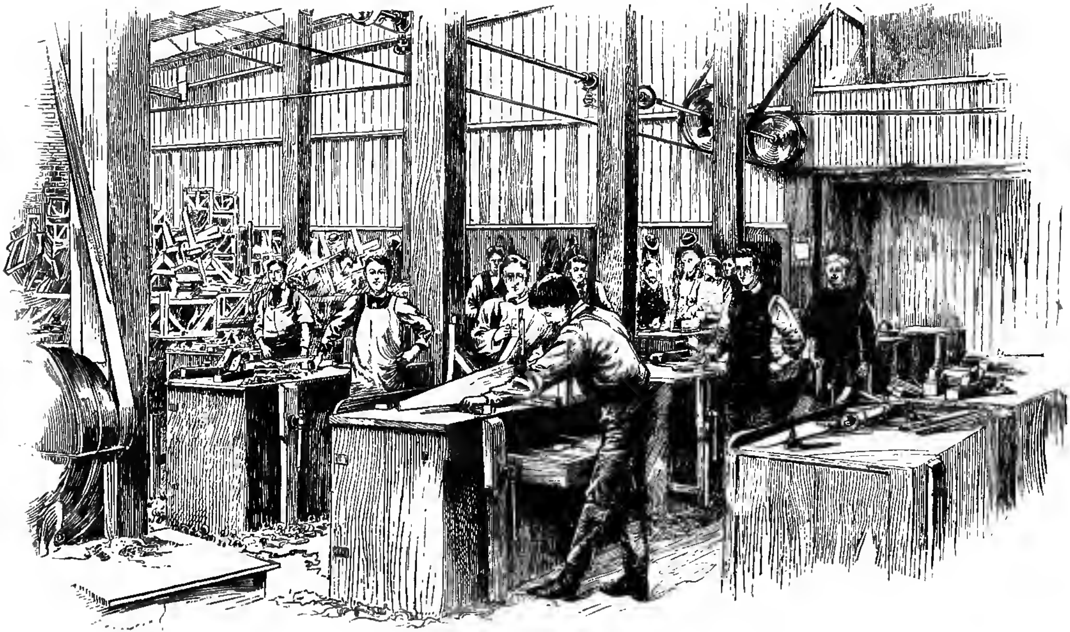
CHAPTER V.

THE CARPENTER'S LABORATORY.

The Natural History of the Pine-tree — How it is Converted into Lumber, what it is Worth, and how it is Consumed.—Where the Students get Information. —Working Drawings of the Lesson.—Asking Questions.—The Instructor Executes the Lesson.—Instruction in the Use and Care of Tools. — Twenty-four Boys Making Things—As Busy as Bees.—The Music of the Laboratory.—The Self-reliance of the Students.

Passing down a flight of stairs and crossing a hall we enter the Carpenter's Laboratory. Here we find twenty-four boys seated before a black-board. At their left stands the instructor with a piece of white pine in his hand. The piece of pine is the subject of his lecture. He frequently breaks the thread of his remarks to ask questions, and he is as frequently interrupted by questions from members of the class. The scene closely resembles an animated discussion, of which a desire to learn by asking questions is the chief characteristic. The discussion is about pine-trees and pine lumber. A pale-faced, city-bred boy rises to describe the pine-tree. He describes a fir-tree, such as may be seen in well-kept urban grounds and parks, and describes it in well-chosen, almost poetic phrase. The instructor shakes his head, but with a genial smile, and recognizes a boy whose face is tanned brown, and who rises at the nod and stands rather awkwardly as he speaks. He has seen the pine in its native wilds, and he describes quite graphically its long, bare trunk and slender limbs. But he says nothing of its narrow, linear leaves, of a dark green color, nor of its woody cones, nor of the Æolian-harp-like sound of the wind in its branches. Why, the instructor wants to know, and he propounds a series of questions, the answers to which afford a brief sketch of the boy's history. His father is a dealer in pine logs, and once this boy went with him into the pineries of Northern Michigan in mid-winter, when the landscape was white with snow, and there saw the huge trees sway back and forth under the woodman's axe, saw them topple over, and heard the loud crash of their fall, saw them trimmed and sawed into mill-logs. He took no note of the woody cones, nor of the narrow leaves of the pine, nor did the sound of the wind in its branches make any impression upon his mind. He saw the pine as his father saw it, with the eyes of a lumberman. He learned just one thing, and learned it so well that he is able to tell the story of the pine-tree from the moment of its fall from the stump in the great forest to its arrival at the mill, and thence, cut into boards, planks, and timber, to the raft or schooner bound for Chicago.

Then the different varieties of the pine-tree are enumerated, and the uses to which their woods are severally adapted mentioned. The countries which chiefly produce the pine-tree are named, and the climatic conditions most favorable to its growth briefly referred to. This discussion leads to the subject of commerce in pine lumber—quantity consumed, demand and supply, etc; and this in turn brings a boy to his feet with the statement that at the present rate of consumption the supply of pine in North America will be exhausted in fifty years. In answer to a question the boy says he read the statement in a newspaper. This leads to further inquiry as



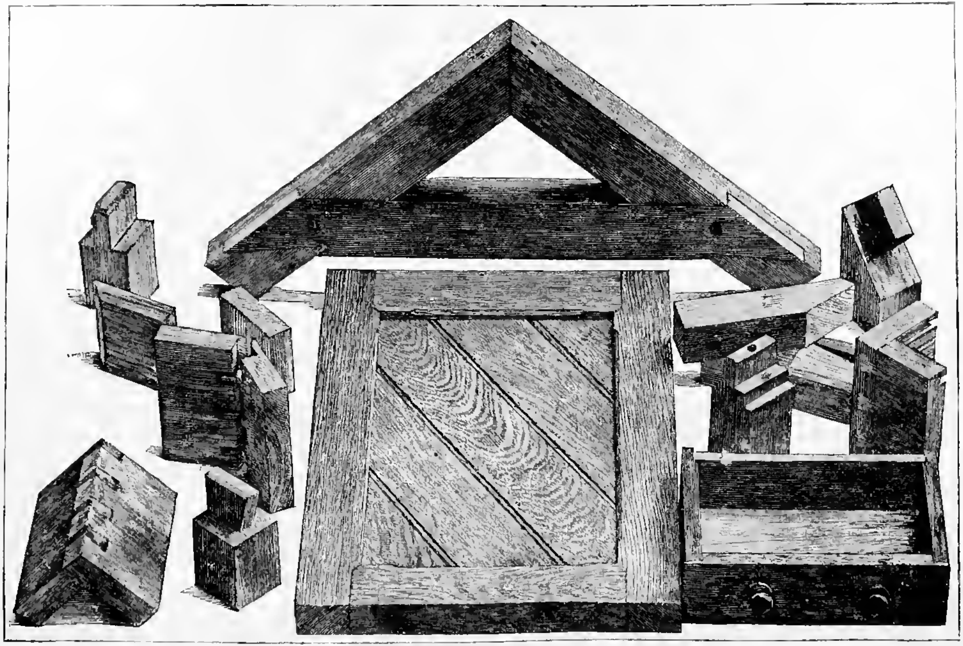
THE LABORATORY OF CARPENTRY.

to the sources of information sought by the members of the class, whereupon it appears that fifteen boys have consulted the title "pine" in some encyclopedia with a view to the present lesson, and that eighteen boys have read the market report under the title "lumber" in a daily journal, in order to learn the value of white-pine boards. The value being stated by half a dozen boys, each member of the class computes the cost of the piece of pine in the hands of the teacher.

Ten minutes having been consumed in the inquiry into the nature and value of the wood in which the lesson of the day is to be wrought, the instructor makes working drawings of the lesson on the black-board. It may consist of a plain joint, a mitre joint, a dove-tail joint, a tenno and mortise, or a frame involving all these and more manipulations. In the few minutes devoted to this exercise any question that occurs to the mind of the student may be asked, and no impatience is manifested or felt if the questions are numerous and reiterated. But as a matter-of-fact very few questions are asked during the black-board exercise, because each student, having gone over every step of it in his drawing-class the day previous, is perfectly familiar with the subject.

The instructor now quits the black-board for the bench, where, in the presence of the whole class, he executes the difficult parts of the lesson, still propounding and answering questions. If a new tool is brought into requisition, instruction is given in its care and use. Now the boys repair to their benches, throw off their coats, and seize their tools. In a moment the silence and repose of the recitation-room are exchanged for the noise and activity of the laboratory. A quarter of an hour ago we left twenty-four boys, with bowed heads, making drawings of things; for a quarter of an hour we have listened to a peculiar kind of recitation involving much practical knowledge on the subject of the pine-tree and its product, lumber; now we stand in the presence of twenty-four boys, in twenty-four different attitudes of labor, making things. They are literally as busy as bees, using the square, the saw, the plane, and the chisel; they are, as the journeyman carpenter would say, "getting out stuff for a job." The coarse, buzzing sound of the cross-cut saw resounds loudly through the room; above this bass note the sharp tenor tone of the rip-saw is heard, and the rasping sound of half a dozen planes throwing off a series of curling pine ribbons comes in as a rude refrain. The faces of the boys are ruddy with the glow of exercise; the pale-faced boy who mistook a fir-tree for a pine will have his revenge on the angular boy from the Michigan pinery, for he is doing a finer piece of work than the other.

In the midst of the harmonious confusion caused by the use of saws, planes, mallets, and chisels, the instructor raps on his desk, and silence is restored; three or four boys stand in a group about the instructor's desk, the others pause and wipe the perspiration from their brows. It is a picture full of interest—twenty-four boys, with flushed, eager faces, lifting their eyes simultaneously to the face of the instructor, waiting for the hint which is to come, and which is sure in these now active minds to result in a prompt solution of the main problem of the day's lesson. A similar question from several boys shows the instructor that the lesson has not been made clear; hence the general explanation which follows the call to order. So the work goes on, with now and then an interruption. There is a student trying to fit a tenon into its mortise; he is nervous and impatient; the instructor observes him,



COURSE IN THE LABORATORY OF CARPENTRY.

foresees a catastrophe, and moves towards his bench. But it is too late! The tenon being forced the mortise splits, and the discomforted student makes a wry face. The instructor approaches with a word of good cheer, but with the warning aphorism that "haste makes waste." The student's face flushes, and he chronicles his failure as Huntsman, the inventor of cast-steel, did his, by burying the wreck under a pile of shavings, and commencing, as the lawyers say, *de novo*. Thus the lesson proceeds "by the usual laboratory methods employed in teaching the sciences;" the class learns the thing to be done by doing it. The students are at their best, because the lesson to be learned compels a close union between the three great powers of man—observation, reflection, and action. No student seeks aid from another, because such a course would be impossible without the knowledge of the whole class. A feeling of self-reliance is thus developed, the disposition to shirk repressed, and a sense of sturdy independence encouraged and promoted.

CHAPTER VI.

THE WOOD-TURNING LABORATORY.

A Radical Change—From the Square to the Circle; from Angles to Spherical, Cylindrical, and Eccentric Forms.—The Rhythm of Mechanics.—The Potter's Wheel of the Ancients and the Turning-lathe—The Speculation of Holtzapffels on its Origin.—The Greeks as Turners.—The Turners of the Middle Ages.—George III. at the Lathe.—Maudslay's Slide-rest, and the Revolution it wrought.—The Natural History of Black-walnut.—The Practical Value of Imagination—Disraeli's Tribute to it; Sir Robert Peel's Want of it.—The Laboratory animated by Steam.—The Boys at the Lathes—Their Manly Bearing.—The Lesson.

When the twenty-four boys of the Carpenter's Laboratory have become expert in the use of the tools employed in carpentry they will be introduced to the Wood-turning Laboratory. The change is radical—from the square to the circle, from the prose to the poetry of mechanical manipulation. Carpentry is distinguished for its corners and angles, turnery for its spherical, cylindrical, and eccentric forms. In these forms Nature abounds and delights, and it is in these forms that the rhythm of mechanics exists. It is by the Turners that the arts are supplied with a thousand and one things of use and beauty. The machines, great and small, from the locomotive to the stocking-knitter—without which the work of the modern world could not be done—these wonderful contrivances, seemingly more cunning than the hand of man, owe their very existence to the turning-lathe.

The skilled instructor in this department of the school

loves to dwell upon the history of turning. Its origin is enveloped in the obscurity of early Egyptian traditions. It is the subject of one of the oldest myths, which runs thus: "Num, the directing spirit of the universe, and oldest of created beings, first exercised the potter's art, moulding the human race on his wheel. Having made the heavens and the earth, and the air, and the sun and moon, he modelled man out of the dark Nilotic clay, and into his nostrils breathed the breath of life."

The Potter's Wheel of the ancients contained the germ of the turning-lathe found in every modern machine-shop, whether for the manipulation of wood or iron. Holtzapffels has an ingenious speculation as to the origin of the invention of the lathe. In his elaborate work on "Turning and Mechanical Manipulation" he says,

"It would appear probable that the origin of the lathe may be found in the revolution given to tools for piercing objects for ornament or use. At first it may be supposed that a spine or thorn from a tree, a splinter of bone or a tooth, was alone used and pressed into the work as we should use a brad-awl. The process would naturally be slow and unsuitable to hard materials, and this probably suggested to the primitive mechanic the idea of attaching a splinter of bone or flint to the end of a short piece of stick, rubbing which between the palms of his hands would give a rotary motion to the tool."

Of the steps of progress in invention, from the rude turning-tools of the ancients down to the beginning of the present century, when Maudslay's improvement made the lathe the king of the machine-shop, little is known. By the Greeks the invention of turning was ascribed to Dædalus. Phidias, who produced the two great masterpieces of Greek art, Athene and Jupiter Olympius, was familiar with the then existing system of wood-turning. In cutting figures on signets and gems in such stones as agate, carnelian, chalcedony, and amethyst, the Greek artificers used the wheel and the style. In the abundant ornamentation of Roman dwellings — their elaborately carved chairs, tables, bedsteads, sofas, and stools — there is ample evidence of a knowledge of the art of turning in wood. Improvements were made in turning-tools, and fine ornamental work was done by the artisans of the Middle Ages, to which the cathedrals and palaces of the time bear witness. Later, during the sixteenth and seventeenth centuries, turning became a fashionable amusement among the French nobility and gentry. Louis XVI. was an expert locksmith, and spent much of his royal time in that pursuit. The fashion extended to England. George III. is said to have been an expert wood-turner, to have been "learned in wheels and treadles, chucks and chisels;" and as a matter of course a pursuit indulged by kings was followed by many nobles. There is, however, no evidence that those distinguished amateurs made any improvements in the tools they used; inventions and discoveries in this as in all departments of art came from the other end of the social scale. When the Spaniards sacked Antwerp in 1585 the Flemish silk-weavers fled to England and set up their looms there; and a century later, upon the revocation of the Edict of Nantes, the silk industry of England received a new accession of refugee artisans consisting of persecuted Protestants. Doubtless with the Flemish weavers there crossed the British Channel representatives of all the practical arts, including that of turning; for in another hundred years England took the front rank among nations in nearly all industrial pursuits.

Among the great inventions and discoveries which distinguished the last quarter of the eighteenth century, Maudslay's slide-rest attachment to the lathe was one of the greatest, if not the greatest. Without it Watt's invention would have been of little more real service to mankind than the French automata of the first quarter of the same century—the mechanical peacock of Degennes, Vaucauson's duck, or Maillardet's conjurer. Mr. Samuel Smiles, in his admirable book on "Iron-workers and Toolmakers," declares that this passion for automata, which gave rise to many highly ingenious devices, "had the effect of introducing among the higher order of artists habits of nice and accurate workmanship in executing delicate pieces of machinery." And he adds, "The same combination of mechanical powers which made the steel spider crawl, the duck quack, or waved the tiny rod of the magician, contributed in future years to purposes of higher import—the wheels and pinions, which in these automata almost eluded the human senses by their minuteness, reappearing in modern times in the stupendous mechanism of our self-acting lathes, spinning-mules, and steam-engines."

That there was a logical connection between the two eras of mechanical contrivance — that of the ingenious automata and that of the useful modern machines—is extremely probable. That the refugee artisans from Antwerp and from France had a stimulating effect upon English invention and discovery there can be little doubt; and that the French automata, which were much written about, and exhibited as a triumph of mechanical genius, became known to and exercised an influence upon the minds of intelligent mechanics is equally probable. We are therefore surprised to find Mr. Smiles arriving at a conclusion in such direct conflict with his general views of the gradual growth of inventions, namely, "that Maudslay's invention was entirely independent of all that had gone before, and that he contrived it for the special purpose of overcoming the difficulties which he himself experienced in turning out duplicate parts in large numbers."

But however this may be, Mr. Maudslay's invention revolutionized the workshop. Before its introduction the tool of the artisan was guided solely by muscular strength and the dexterity of the hand; the smallest variation in the pressure applied rendered the work imperfect. The slide-rest acting automatically changed all that. With it thousands of duplicates of the most ponderous, as well as the most minute pieces of machinery, are executed with the utmost precision. Without it the steam-engine, whether locomotive or stationary, would have been hardly more than a dream of genius; for the monster that is to be fed with steam can be properly constructed only by automatic steam-driven tools; or, as another has expressed it, "Steam-engines were never properly made until they made themselves."

Ten minutes are thus agreeably and profitably occupied by the instructor in a review of the history of a single invention, and its relations to the whole field of mechanical work.

Another branch of the lesson consists of an inquiry into the natural history, qualities, value, and common uses of the wood which is to be the material of the day's manipulation—black-walnut. Holding a piece of the purplish brown wood high in his hand the instructor discharges, as it were, a volley of questions at the class, "What is it called?" "Where is it found?" "How large does the tree grow?" "For what is the wood chiefly used?" Up go a dozen hands. The owner of one of the hands is recognized, and he rises to tell all about it, but is only allowed to say "black-walnut." The next speaker is permitted to say that "the black-walnut is found all over North America;" the next that it is more abundant west of the Alleghanies, and most abundant in the valley of the Mississippi; the next that in a forest it has a limbless trunk from thirty to fifty feet high, but in the "open" branches near the ground; the next that it is extensively used in house-finishing, in furniture, for all kinds of cabinet-work, and especially for gunstocks.

Further inquiry elicits the information that the black-walnut is a quick-growing, large tree; that its wood is hard, fine-grained, durable, and susceptible of a high polish, and that through use and exposure it turns dark, and with great age becomes almost black. One student describes the leaves, another the fruit or nuts, and states that they are used in dyeing; a third states that the black-walnut is a great favorite for planting in the treeless tracts of the West, on account of its rapid growth and the value of its timber. When the subject appears to be nearly exhausted, a boy at the farther end of one of the forms rises timidly and tells the story of the late Mr. W. C. Bryant's great black-walnut-tree at Roslyn, Long Island. He concludes, excitedly, "It is one hundred and seventy years old and twenty-five feet in circumference."*

* "At Ellerslie, the birthplace of Wallace, exists an oak which is celebrated as having been a remarkable object in his time, and which can scarcely, therefore, be less than seven hundred years old. Near Staines there is a yew-tree older than Magna Charta (1215), and the yews at Fountains Abbey, in Yorkshire, are probably more than

The timid boy dwells upon his story of the "big" tree with evident fondness, and his eyes dilate with satisfaction as he resumes his seat. The circumstance of the great age no less than the enormous size of the tree has captivated his imagination. The discriminating instructor will not fail to note such incidents of the lesson. It is through them that the special aptitudes of students are disclosed. The instructor will always bear prominently in mind that the purpose of the school is not to make mechanics but men. Nor will he forget, as Buckle remarked, that Shakespeare preceded Newton. Buckle pays a glowing tribute to the usefulness of the imagination. He says, "Shakespeare and the poets sowed the seed which Newton and the philosophers reaped. . . . They drew attention to nature, and thus became the real founders of all natural science. They did even more than this. They first impregnated the mind of England with bold and lofty conceptions. They taught the men of their generation to crave after the unseen."

Disraeli, in his matchless biography of Lord George Bentinck, in summing up the character of a great English statesman is equally emphatic in praise of the imagination as a practical quality. He says,

"Thus gifted and thus accomplished, Sir Robert Peel had a great deficiency — he was without imagination. Wanting imagination, he wanted prescience. No one was more sagacious when dealing with the circumstances before him; no one penetrated the present with more acuteness and accuracy. His judgment was faultless,

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twelve hundred years old. Eight olive-trees still exist in the Garden of Olives at Jerusalem which are known to be at least eight hundred years old." — "Vegetable Physiology." By William B. Carpenter, M.D., F.R.S., F.G.S. London: Bell and Daldy. 1865. p. 78.

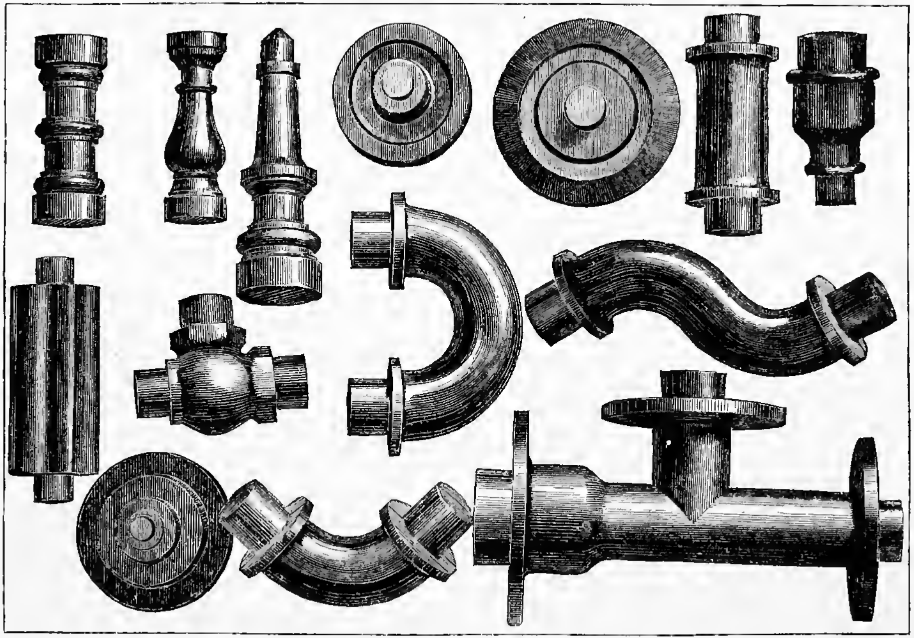
provided he had not to deal with the future. Thus it happened through his long career, that while he always was looked upon as the most prudent and safest of leaders, he ever, after a protracted display of admirable tactics, concluded his campaigns by surrendering at discretion. He was so adroit that he could prolong resistance even beyond its term, but so little foreseeing that often in the very triumph of his manœuvres he found himself in an untenable position."

The timid boy has imagination; if he has application and the logical faculty he may become an inventor, or he may become an artist—an engraver or a designer of works of art—or he may become a man of letters. To the man of vivid imagination and industry all avenues are open; Disraeli's wonderful career offers a striking illustration of the truth of this proposition. The true purpose of education is the harmonious development of the whole being, and the purpose of this turning laboratory is to educate these twenty-four boys, not to make turners of them.

The laboratory is a labyrinth of belts, large and small, of wheels, big and little, of pulleys and lathes. A student, at a word from the instructor, moves a lever a few inches, and the breath of life is breathed into the complicated mass of machinery. The throbbing heart of the engine far away sends the currents of its power along shafting and pulleys. The dull, monotonous whir of steam-driven machinery salutes the ear, and the twenty-four students take their places at the lathes. They are from fourteen to seventeen years of age, and range in height from undersize to "full-grown." They look like little men. Their faces are grave, showing a sense of responsibility. They are to handle edge-tools on wood rapidly revolved by the power of steam. There is peril in an uncautious step, and death lurks in the shafting. Of these dangers they have been repeatedly warned; and there is in their bearing that manifestation of wary coolness which we call "nerve," and which in an emergency develops into a lofty heroism capable of sublime self-sacrifice.

This is the very essence of education, its informing spirit. The student no longer thinks merely of becoming an expert turner; he thinks of becoming a man! All the powers of his mind are roused to vigorous action; the imagination illumes the path, and the reason, following with firm but cautious step, drives straight to the mark. Rapid development results from the combination of practice with theory—rapid because orderly, or natural. The knowledge acquired is at once assimilated, and becomes a mental resource, subject to draft like a bank account. But unlike a bank account it increases in the ratio of the frequency with which drafts are made upon it, and the result is the student leaves school at seventeen years of age with the reasoning experience of an ordinarily educated man of forty.

The lesson has been announced by the instructor, its chief points stated and analyzed, its place in the scale (so to speak) of the art of turnery defined, its educational value to the mind, the hand, and the eye shown, and the points of difficulty involved so emphasized as to lead to painstaking care in the execution of crucial parts. The new tool required by the lesson is handled in presence of the waiting class by the instructor; the time of its invention stated; the name of its inventor given; the method of its manufacture described; and how to sharpen, take care of, and use it explained with such minuteness of detail as to insure the making of a permanent impression upon the minds of students.



COURSE IN THE WOOD-TURNING AND PATTERN LABORATORY.

The wood-turner's case contains more than a hundred tools, perhaps a hundred and fifty, but not more than a score of them are fundamental; the others are subsidiary, and require very little if any explanation.

The lesson may be one in simple turning, as a table-leg, the round of a chair, or parts of a section of a miniature garden-fence; or it may be a set of pulleys, or patterns for various forms of pipe. The pieces of wood to be wrought or manipulated lie at the feet of the student, and the working drawing (drawn by the student himself) lies on the bench before him. The piece of wood to be turned first is adjusted, the student touches a lever over his head which sets the lathe in motion, takes the required tool in hand, and the work begins. Guided by the automatic slide-rest, the sharp point of the tool chips away the revolving wood until it assumes the form of the drawing lying under the eye of the operator. Thus the lesson proceeds to the end of the prescribed period—two hours. The master watches every step of its progress. If a student is puzzled he receives prompt assistance, so that no time may be lost. Indeed the relations between instructor and students are such, or ought to be such, that the question is asked before the puzzled mind falls into a rut of profitless speculation through revolving in a circle. But if the true sequential method of study is followed the student rarely fails, from the vantage ground of a step securely taken, to comprehend the nature of the next step in the regular order of succession. This is the Russian system, and it is the method of the wood-turnery as well as of every department of the Manual Training School. Hence a certain tool having been mastered, the next tool in the regular order of succession is more easily mastered, because (1) each tool contains a hint of the nature of its successor, and (2) each addition to the student's stock of knowledge confers an increased capability of comprehension.

When the lesson is concluded the whir of the machinery ceases, and a great silence falls upon the class as the students assemble about the instructor, each presenting his piece of work. This is the moment of friendly criticism. The instructor handles each specimen, comments upon the character of the workmanship, points out its defects, and calls for criticisms from the class. These are freely given. There is an animated discussion, involving explanations on the part of the instructor of the various causes of defects, and suggestions as to suitable methods of amendment. Then the pieces of work are marked according to the various degrees of excellence they exhibit, and the class is dismissed.

CHAPTER VII.

THE FOUNDING LABORATORY.

The Iron Age.—Iron the King of Metals.—Locke's Apothegm.—The Moulder's Art is Fundamental.—History of Founding.—Remains of Bronze Castings in Egypt, Greece, and Assyria.—Layard's Discoveries.—The Greek Sculptors.—The Colossal Statue of Apollo at Rhodes.—The Great Bells of History.—Moulding and Casting a Pulley.—Description of the Process, Step by Step.—The Furnace Fire.—Pouring the Hot Metal into the Moulds.—A Pen Picture of the Laboratory.—Thus were the Hundred Gates of Babylon cast.—Neglect of the Practical Arts by Herodotus.—How Slavery has degraded Labor.—How Manual Training is to dignify it.

As we enter the Founding Laboratory we recall Locke's apothegm: "He who first made known the use of that contemptible mineral [iron] may be truly styled the father of arts and the author of plenty." We reflect, too, that the mineral that has given its name to an age of the world—our age—is worthy of careful study.

The Founding Laboratory, like all the laboratories of the school, is designed for twenty-four students. There are twenty-four moulding-benches, combined with troughs for sand, and a cupola furnace where from five hundred to one thousand pounds of iron may be melted.

The students we lately parted from in the Wood-turning Laboratory are here. Their training has been confined to manipulations in wood; they are now to be made acquainted with iron—iron in considerable masses. They should know something, in outline, of the history of the king of metals in the Founding Laboratory. The instructor speaks familiarly to them, somewhat as follows:

The art of the founder is fundamental in its nature. The arts of founding and forging are, indeed, the essential preliminary steps which lead to the finer manipulations entering into all metal constructions. Whether forging preceded founding or founding forging is immaterial; both arts are as old as recorded history—much older indeed. Moulding, which is the first step in the founder's art, should be among the oldest of human discoveries, since man had only to take in his hand a lump of moist clay to receive ocular evidence of his power to give it any desired form.

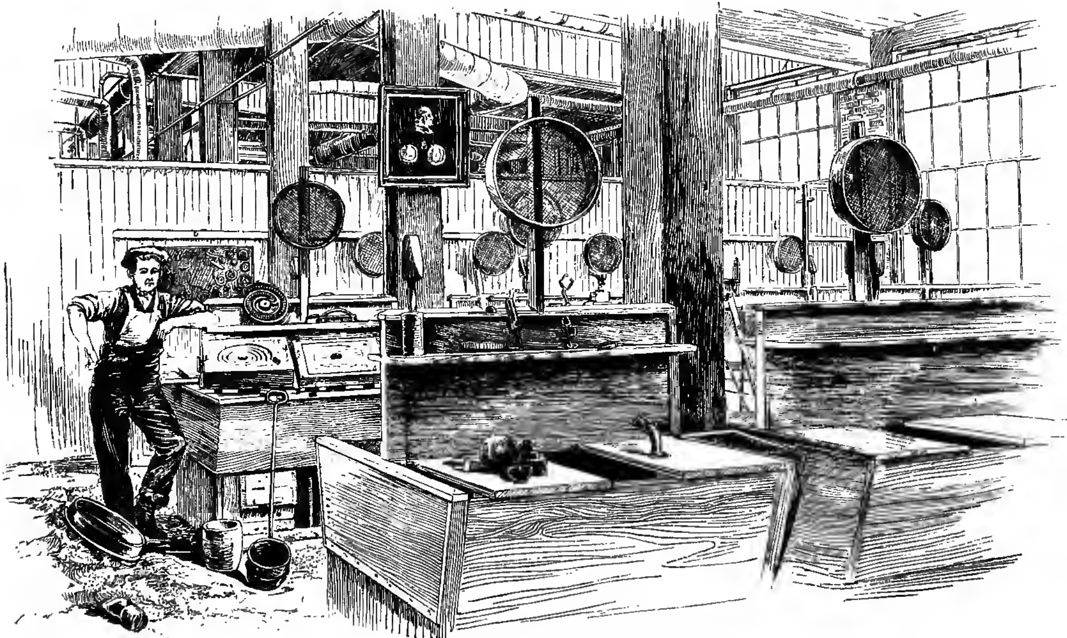
Moulding for casting is closely allied to the potter's art. The potter selects a clay suitable for the vessel he desires to mould, and the founder prepares a composition of sand and loam of the proper consistency to serve as a matrix for the vessel he desires to cast.

The art of founding was doubtless first applied to bronze. The ruins of Egypt and Greece abound in the remains of bronze castings, an analysis of which reveals about the same relative proportions of tin and copper in use now for the best qualities of statuary bronze. The bronze castings of the Assyrians show a high degree of art. Many specimens of this fine work of the Assyrian founder have been rescued from the ruins of long-buried Nineveh—buried so long that Xenophon and his ten thousand Greeks marched over its site more than two thousand years ago without making any sign of a knowledge of its existence, and Alexander fought a great battle in its neighborhood in apparent ignorance of the fact that he trod on classic ground. But there, delving beneath the rubbish and decayed vegetation of four thousand years or more, Layard found great treasures of art in the palaces of Sennacherib and other Assyrian monarchs—vases, jars, bronzes, glass-bottles, carved ivory and mother-of-pearl ornaments, engraved gems, bells, dishes, and ear-rings of exquisite workmanship, besides arms and a variety of tools of the practical arts.

In Greece, in the time of Praxiteles, bronze was moulded into forms of rare beauty and grandeur. The colossal statue of Apollo at Rhodes affords an example of the magnitude of the Greek castings. It was cast in several parts, and was over one hundred feet high. About fifty years after its erection it was destroyed by an earthquake. Its fragments lay on the ground where it fell, nearly a thousand years; but when the Saracens gathered them together and sold them, there was a sufficient quantity to load a caravan consisting of nine hundred camels. One of the finest existing specimens of ancient bronze casting is that of a statue of Mercury discovered at Herculaneum, and now to be seen in the museum at Naples.

During the era of church bells the founder exercised his art in casting bells of huge dimensions. Early in the fifteenth century a bell weighing about fifty tons was cast at Pekin, China. This bell still exists, is fourteen and a half feet in height and thirteen feet in diameter. But the greatest bell-founding feat was, however, that of 1733, in casting the bell of Moscow. This bell is nineteen feet three inches in height and sixty feet nine inches in circumference, and weighs 443,772 pounds. The value of the metal entering into its construction is estimated at $300,000. It long lay in a pit in the midst of the Kremlin, but Czar Nicholas caused it to be raised, mounted upon a granite pedestal, and converted into a chapel. The methods of casting employed by the founder of this king of bells are not known. The bell has outlived the Works where it was cast. The melting and handling of two hundred and twenty tons of bronze metal certainly required appointments, mechanical and otherwise, of the most stupendous character; and the existence of such Works presupposes an intimate acquaintance with the most minute details of the founder's art, since the natural order of development is from the less to the greater. That is to say, the founder who could manipulate scores of tons of metal in a single great casting could doubtless manipulate a few pounds of metal; or, the founder who could cast a bell weighing two hundred and twenty tons, could cast pots and kettles and hundreds of other little useful things. What we hope to do in this school Founding Laboratory is to gain a correct conception of great things by making ourselves thoroughly familiar with many forms of little things in moulding and casting.

The lesson of the day is the moulding and casting of a plain pulley. In the Pattern Laboratory each student has already executed a pattern of the pulley to be cast, and the pattern lies before him on his moulding-bench. Now the instructor, at the most conspicuous bench in the room, proceeds to execute the first part of the lesson, which consists of moulding. Taking from the trough a handful of sand, he explains that it is only by the use of sand possessing certain properties, as a degree of moisture, but not enough to vaporize when the metal is poured in, and a small admixture of clay, but not enough to make of the compound a loam, that the mould can be saved from ruin through vaporization, and, at the same time, given the essential quality of adhesiveness or plasticity. In the course of this explanation he remarks that the sand used in some parts of the mould is mixed with pulverized bituminous coal, coke, or plumbago, in



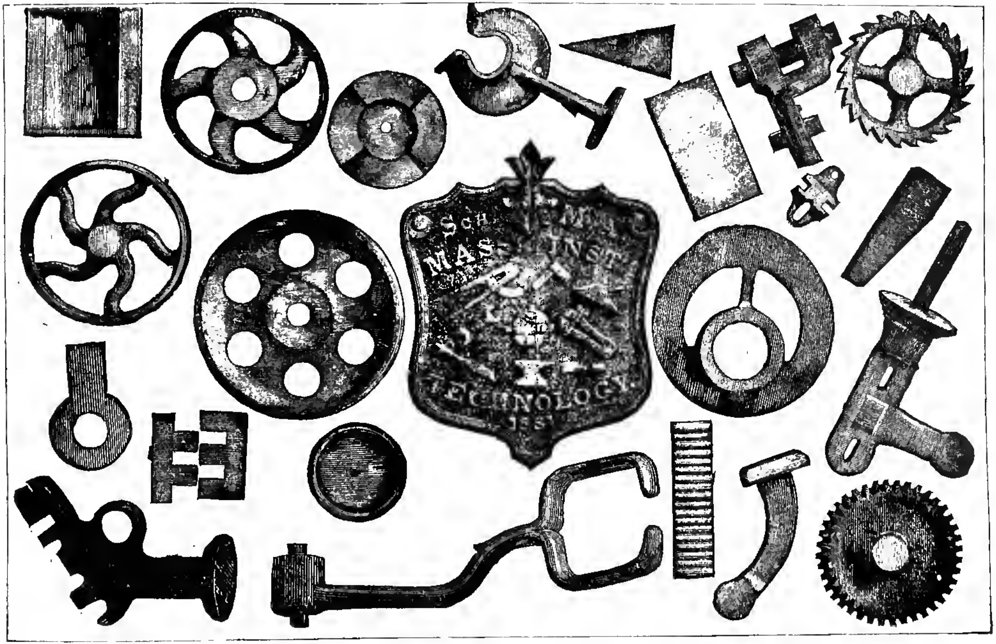
THE FOUNDING LABORATORY.

order to give a smoother surface. Now he takes the "flask"—a wooden apparatus containing the sand in which the mould is made—and explains its construction and use. From this point—the sifting of facing sand on the turn-over board, to the final one of replacing the cope and securing it with keys or clamps—every step of the process is carefully gone through with and explained.

Meantime, before the moulding lesson has proceeded far, a fire is kindled in the furnace and it is "charged;" that is to say, filled with alternate layers of coal and pig-iron, with occasional fluxes of limestone. During the process of charging the furnace the instructor explains the principle of its construction, and shows how it operates. At every subsequent rest in moulding the students surround the furnace to witness the progress of the fire, the position of the layers of coal, and the state of combustion. They pass the furnace in procession, and each peeps in through the isinglass windows upon the glowing fire, asks a question, or a dozen questions, perhaps, and gives place to the next student in line. In the intervals of these visits to the furnace the work of making twenty-four moulds goes on under the eye of the instructor, the students explaining each step in advance. He is omnipresent, answering a question here, preventing a fatal mistake there, cheering, inspiring, and guiding the whole class, but never insisting upon a slavish adherence to strict identity in processes. And it is to be noted that there is in moulding more latitude for independence than in almost any other mechanical manipulation. Certain essentials there are, of course, but these being secured, the student may exercise his ingenuity in the execution of many minor details. That there is considerable individuality in the class may be seen by observation of the different methods employed by the several young moulders to compass various details of the same general process.

The moulds are nearly completed. The instructor assists a student who is found to be a little behind in his work, and interposes a warning against haste at the critical moment. Within the space of a period of ten minutes the twenty-four patterns are "tapped," loosened, and lifted from their beds, imperfections are carefully repaired with the trowel, or some other tool, channels to the pouring holes are cut in the surfaces, the pieces remaining in the copes are removed, the particles of loose sand are blown from the surfaces of the moulds, and the twenty-four copes are replaced, and secured with keys or clamps.

A final visit is now made to the furnace. The fusion is found to be complete; the "pigs" are converted into a molten pool. It only remains to pour the hot metal into the moulds. The instructor seizes an iron ladle lined with clay, holds it under the spout of the furnace reservoir until it is nearly filled with the glowing fluid, lifts and carries it carefully across the room, and pours the contents into a mould. Then the students, in squads, after having been cautioned as to the deadly nature of the molten mass they are to handle, follow the example of their instructor. At this moment the laboratory appeals powerfully to the imagination. The picture it presents is weird in the extreme. From the open furnace door a stream of crimson light floods the room. The students wear paper caps and are bare-armed; their faces glow in the reflected glare of the furnace-fire; they march up to the furnace one by one, each receiving a ladleful of steaming hot metal, and countermarch to their benches,



COURSE IN THE FOUNDING LABORATORY.

where they pour the contents of their ladles into the moulds.

Still holding his empty ladle in his hand, the instructor watches the progress of the lesson with keen interest until the last stream of metal has found its way into the throat of the last mould. He recalls the story of Vulcan, the God of Fire, and of all the arts and industries dependent upon it, and wonders why he was not depicted pouring tons of molten metal in the foundery rather than sledge in hand at the forge. Then he regards the class with a benignant expression of pride, begs for silence, and says, "Thus were the hundred brazen gates of ancient Babylon cast long before the beginning of the Christian era." Herodotus did not think to tell us much of the state of the useful arts in the early time of which he wrote, but the brazen gates attracted his attention, and he described them: "At the end of each street a little gate is found in the wall along the river-side, in number equal to the streets, and they are all made of brass, and lead down to the edge of the river." Could Herodotus have foreseen what a deep interest his readers of this remote time would take in the history of the useful arts, he would have written less about the walls, palaces, and temples of Babylon, and more about the artificers. He would have begged admission to the forges and founderies of the city; he would have visited the Assyrian founder at his work, questioned him about his processes, and set down his answers with painstaking care. Then he would have sought an introduction to the smithy, and from the grimy forger learned what he could tell of his art and of kindred arts. So the father of history might have made an enduring record of the real things which throughout all time have contributed to the advancement of the human race, rather than of events growing out of the ambitions and passions of men —the rise and fall of kingdoms and empires, the varying fortune of battle, the treacheries, crimes, and brutalities of rulers, and the cringing submission of millions of subjects. But, alas, the founders and smiths, and all the other cunning artificers of the vast empire of Syria, were slaves! and through their ancestry for unnumbered generations the stigma of slavery had attached to labor. Ay, on the bare backs of the founders of Babylon's brazen gates the popular scorn of labor had doubtless left its livid brand.

With these pariahs of Assyrian society, these outcasts of the social circle, the great Greek historian could not even speak. Descended from a long line of noble Halicarnassian families, Herodotus felt all the prejudices of the hereditary aristocracy of his country. Hence he dilates upon the wonders of Babylon, but is silent as to its architects and artisans. He describes with great minuteness of detail the tower of Jupiter Belus, but gives no hint of the name of its designer and builder. He declares that Babylon was adorned in a manner surpassing any city of the time, but in regard to the artificers through whose ingenuity and skill such pleasing effects were produced he gives no sign.

The silence of Herodotus on the subject of the useful arts in Babylon does not indicate a want of appreciation of their value, but merely shows contempt of the Assyrian artisan, and this not because he was an artisan, but because he was a slave. The story of Solon and Crœsus, which antedates Herodotus, whether true or a myth, shows that iron and artisanship were appreciated by both Greeks and barbarians. When Crœsus had exhibited to the Greek sage his vast hoard of treasures, Solon said, "If another comes that hath better iron than you he will be master of all this gold." Here is a recognition of the immense value of the arts of smelting and forging, coupled with a contemptuous silence regarding as well the smelter and the smith as the rank and file of the armies who should wield the swords and spears drawn by science from the recesses of the earth, and by art wrought and tempered at the forge. Through all the early ages the brand and scorn of slavery adhered to labor, while the arts, the products of labor, were often deified. Thus the Scythian, who from a grinning skull drank the warm blood of his captive, regarded with superstitious awe as a god the iron sword with which he cut off his captive's head.

It was only with the revival of learning, after the intellectual and moral gloom of the Dark Ages, that labor began slowly to lift its bowed head and assert itself. But it does not yet stand erect. It still stoops as if in the presence of a master. Every now and then it winces and cringes as if the sound of the descending lash smote its ear. It remains for you, students in this school of the arts—all the arts that make mankind good and great—it remains for you to brush away from the tear-stained face of labor all the shadows accumulated there through all the dead ages of oppression and slavery. It remains for you to make labor bold by making it intelligent. It remains for you to dignify and ennoble labor by bestowing upon it the ripest scientific and artistic culture, and devoting to its service the best energies of body and mind.

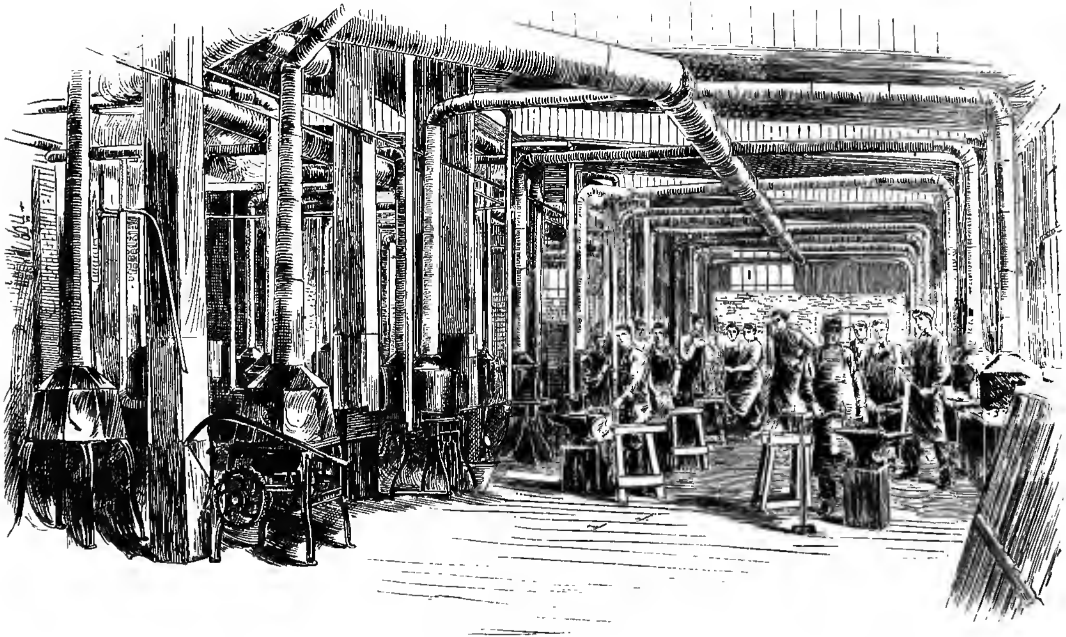
CHAPTER VIII.

THE FORGING LABORATORY.

Twenty-four manly-looking Boys with Sledge-hammer in Hand—their Muscle and Brawn.—The Pride of Conscious Strength.—The Story of the Origin of an Empire.—The Greater Empire of Mechanics.—The Smelter and the Smith the Bulwark of the British Government.—Coal—its Modern Aspects; its Early History; Superstition regarding its Use.—Dud. Dudley utilizes "Pit-coal" for Smelting—the Story of his Struggles; his Imprisonment and Death.—The English People import their Pots and Kettles.—"The Blast is on and the Forge Fire sings."—The Lesson, first on the Black-board, then in Red-hot Iron on the Anvil.—Striking out the Anvil Chorus—the Sparks fly whizzing through the Air.—The Mythological History of Iron.—The Smith in Feudal Times—His Versatility.—History of Damascus Steel.—We should reverence the early Inventors.—The Useful Arts finer than the Fine Arts.—The Ancient Smelter and Smith, and the Students in the Manual Training School.

This is the Forging Laboratory. It is only a few steps from the laboratory for founding, where we lately saw twenty-four students taking off their leather aprons after a two hours' lesson in moulding and casting. Here we find, also, twenty-four students, but not the twenty-four we saw in the laboratory for founding. This class is more advanced. The boys are a trifle taller; they show more muscle, more strength, and bear themselves with a still more confident air.

In the Forging Laboratory there are twenty-four forges with all essential accessaries, as anvils, tubs, and sets of ordinary hand-tools.



THE FORGING LABORATORY.

The students, with coats off and sleeves rolled above their elbows, in pairs, as smith and helper, stand, sledge and tongs in hand, at twelve of the forges. They are manly-looking boys. Their feet are firmly planted, their bodies erect, their heads thrown a little back. Their arms show brawn; the muscles stand out in relief from the solid flesh. Their faces express the pride of conscious strength, and their eyes show animation.

As we regard the class with a sympathetic thrill of satisfaction, the story of the origin of the Turkish Empire is recalled: "A race of slaves, living in the mountain regions of Asia, are employed by a powerful Khan to forge weapons for his use in war. A bold chief persuades them to use the weapons forged for a master to secure their own deliverance. For centuries after they had thus conquered their freedom, the Turkish people celebrated their liberation by an annual ceremony in which a piece of iron was heated in the fire, and a smith's hammer successively handled by the prince and his nobles."

The greatest empire in the world to-day is the empire of the art of mechanism, and its most potent instrument is iron. Once the perpetuity of governments depended upon the mere possession of the dingy ore. When Elizabeth came to the throne, in the middle of the sixteenth century, England was almost defenceless, owing to the short supply of iron. Spain, much better equipped, hence relied confidently upon her ability to subdue the English. But the Virgin Queen, comprehending the nature of the crisis, imported iron from Sweden and encouraged the Sussex forges, and the Spanish Armada was defeated. Thus the smelter and the smith became the bulwark of the British government.

But at an earlier period the fraternity of smiths gave direction to the course of empire. The secret of the easy conquest of Britain by the Normans was their superior armor. They were clad in steel, and their horses were shod with iron. The chief farrier of William became an earl; and he was proud of his origin, for his coat of arms bore six horseshoes.

Iron and civilization are terms of equivalent import. Iron is king, and the smelter and smith are his chief ministers. It is not known when, by whom, or how the art of smelting iron was discovered. As well ask by whom and how fire was discovered? These are secrets of the early morning of human life—of that time when man made no record of his struggles.

In lieu of history the instructor resorts to tradition, repeating the following legend: "While men were patiently rubbing sticks to point them into arrows, a spark leapt forth and ignited the wood-dust which had been scraped from the sticks, and so fire was found."

Now the "helper" looks to his "blast" with keen interest; for the management of the forge-fire is one of the niceties of the smith's art. He stirs the fire a little impatiently. The instructor heeds the act, but not the movement of impatience. On the contrary he seizes the occasion to bring up the subject of coal. Question follows question in rapid succession, and the answers are prompt and satisfactory, touching all modern aspects of the subject, namely, the magnitude of the annual "output," the localities of heaviest production, the cost of mining; the uses, respectively, to which different qualities are applied, demand and supply, and market value or price. Here the instructor remarks that the mining, transportation, and sale of coal are conducted in this country by a number of large corporations, with an aggregate capitalization and bonded indebtedness of six or seven hundred million dollars, and that through combinations between these corporations the price is often arbitrarily advanced. "But," he concludes, "the discussion of that branch of the subject belongs more properly to the class in political economy."

The history of coal in its relation to iron smelting and manufacture forms a curious chapter in the vicissitudes of the useful arts. One hundred and fifty years ago not only all the smith's fires but the smelter's fires were kept up with charcoal. The forests of England were literally swept away, like chaff before the wind, to feed the yawning mouths of the iron mills. To make a ton of iron required the consumption of hundreds of cords of wood. To save the timber restrictive legislation was adopted, and the mills were gradually closed for want of fuel, until, in 1788, there was not one left in Sussex, and only a small number in the kingdom. Meantime the English iron supply came from Sweden, Spain, and Germany. England seemed to be following in the footsteps of the Roman Empire. The Romans accomplished in iron smelting and forging just what might be expected of a warlike people. They required iron for arms and armor, and in smelting skimmed the surface. This is proven by the cinder heaps, rich in ore, which they left in Britain. Archæologists trace the decline of Rome in her monuments, which show a steady deterioration in the soldier's equipment. Alison attributes this decline to the exhaustion of her gold and silver mines. A far more plausible conjecture is found in the waste of timber in fuel for smelting purposes, and the resulting failure of the iron supply.

The fall of the Roman Empire may be accounted for by her neglect of the useful arts. The nation that converts all her iron into swords and spears shall surely perish. Had the city of Seven Hills possessed seven men of mechanical genius like Watt, Stephenson, Maudslay, Clement, Whitney, Neilson, and Nasmyth, her fall might have been averted, or if not averted, it need not have involved the practical extinction of civilization, thus imposing upon mankind the shame of the Dark Ages.

At the beginning of the seventeenth century there was much ignorant prejudice against the use of mineral coal. It was believed to be injurious to health. All sorts of diseases were attributed to its supposed malignant influence, and at one time to burn it in dwellings was made a penal offence. But this prejudice did not extend to its use in smelting iron, and whatever there was of inventive genius was devoted to a solution of the problem of its adaptation to such purposes. Mr. Samuel Smiles has collected the names of the most prominent of these Dutch and German mechanics, namely, Sturtevant, Rovenzon, Jordens, Francke, and Sir Philibert Vernatt, and given each a niche in the temple of fame. Some of them had a true conception of the required processes, but they all failed to render the application practically available.

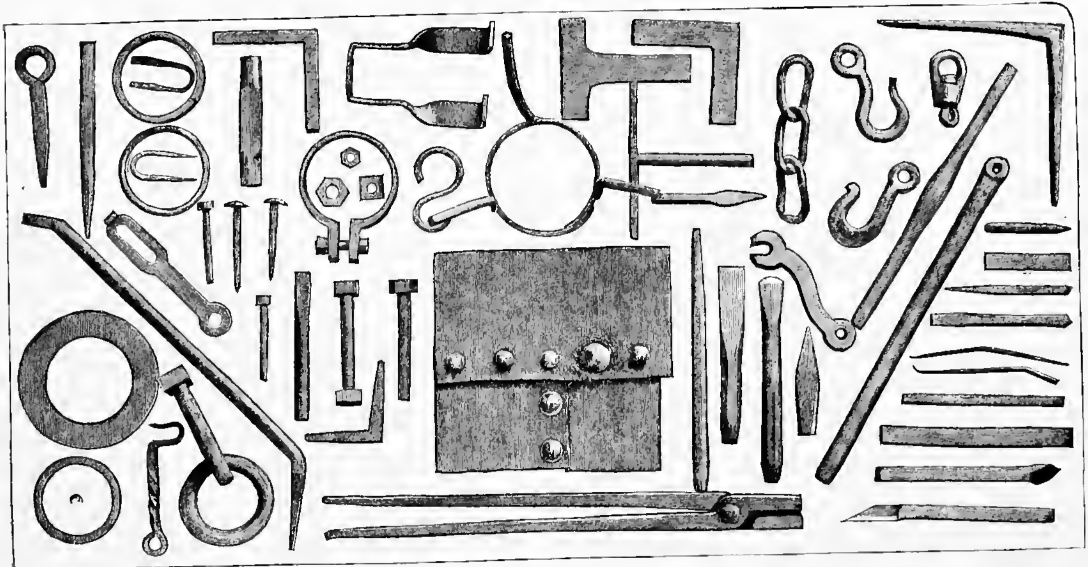
It remained for Dud. Dudley to succeed in making a thoroughly practical application of mineral coal to iron-smelting purposes, and then curiously enough to fail of success in introducing it into general use. Dudley was born in 1599, in an iron-manufacturing district. His father owned iron-works near the town of Dudley, which was a collection of forges and workshops where "nails, horseshoes, keys, locks, and common agricultural tools" were made. Brought up in the neighborhood of "twenty thousand smiths and workers in iron," young Dudley "attained considerable knowledge of the various processes of manufacture." At twenty years of age he was taken from college and placed in charge of a furnace and two forges in Worcestershire, where there was a scarcity of wood but an abundance of mineral coal. He began immediately to experiment, with a view to the substitution of the latter for the former, and in a year succeeded in demonstrating "the practicability of smelting iron with fuel made from pit-coal, which so many before him had tried in vain." But the charcoal iron-masters combined to resist the new method because it cheapened the product. They instigated mobs to destroy Dudley's furnaces one after another, as soon as they were completed, harassed him with lawsuits, and finally beggared and drove him to prison. Then they tried to wring his secret from him. To this attempt Cromwell, who was interested in furnaces in the Forest of Dean, is said to have been a party. But all these efforts failed, and Dudley died in 1684 carrying his secret with him to the grave, and there the secret slumbered nearly one hundred years.

The story of Dud. Dudley, as told by Mr. Smiles in his "Iron-workers and Tool-makers," is one of surpassing interest. It is worthy the careful perusal not only of every school-boy but of the philosophic student in search of the lessons of history, for it affords fresh evidence of the truth of the proposition that the progress of civilization depends upon progress in invention and discovery.

Under the influence of ignorance, prejudice, and superstition the iron industry of England continued to decline until the beginning of the eighteenth century, when the British people imported their pots and kettles. Fifty years later, at the Coalbrookdale iron-works in Shropshire, when the furnaces had consumed all the wood in the neighborhood and a fuel famine was imminent, smelting with mineral coal was successfully resumed, and in 1766 two workmen of the "works"—the brothers Cranege—invented the reverberatory furnace, which added immensely to the application of coal to smelting purposes.

But while we are discussing the history of coal we are consuming coal to little purpose, for the blast is on and the furnace fires glow like miniature volcanic craters. Let us to work. Before the black-board, chalk in hand, the instructor stands and gives out the lesson. He presents it in the form of drawings, complete and in detail. It may involve only the single process of "drawing," or it may involve several processes, as "drawing," "bending," and "welding." The first sketch, for example, represents a flat bar of iron, the counterpart of the bars resting against the several forges. The second sketch shows the bar wrought into the form of a cylinder. The third sketch shows it "drawn" or lengthened, and hence reduced in size. The fourth sketch presents two rods the united lengths of which equal the length of the original rod. The fifth sketch represents the two rods "bent" into the form of chain-links, and a sub-sketch shows the proper shape of the ends of the links for "welding." The sixth sketch shows the two links joined and welded.

The black-board illustrations may be omitted if the school is provided with a complete set of samples. The school of mechanic arts of the Massachusetts Institute of Technology has a hundred samples representing the successive steps in blacksmithing manipulation, including welding, and the welding samples consist of two parts, the first representing the details of the piece prepared for welding, and the second the welded piece. These



COURSE IN THE FORGING LABORATORY.

samples are part of a collection of three hundred and twenty pieces of exquisite workmanship, covering every department of a complete manual training course, presented to the Institute in 1877 by the Emperor of Russia.

The black-board illustrations or the samples having been exhibited and explained as clearly as is possible in words, the instructor takes his place at one of the forges, and, surrounded by the class, goes through with the successive steps of any manipulation contained in the lesson which has not been actually wrought out in some previous lesson.

If the manipulation is a simple one the silence is only broken by the sound of the blast and the stroke of the hammer—the students understand every turn of the iron and every blow struck by the instructor—but if the manipulation is complicated, involving a fresh principle, the instructor is saluted by a volley of questions, and he often pauses to answer them. It is the time for questions; the more questions now, the fewer questions when all the blasts shall be on, and all the sledges flying through the air and making music on the anvils. A question now may lead to the enlightenment of twenty-four students; a question later is sure to cost the time of twenty-four students, and the answer to it may enlighten only one student.

At last the instructor drops the sledge, straightens up to his full height, and wipes the sweat from his brow. If the students respect the instructor they will respect labor, and they will respect the instructor if he is worthy of respect.

Now the school-room is a smithy and yet it is not. It is neither very hot nor very smoky, for there is an exhaust fan in operation which vitalizes the circulation. But the atmosphere resounds with the clangorous strokes of a dozen sledges, mingled with the sullen roar of as many forge-fires; and there are traces of soot on the walls, and pale smoke-wreaths creep along the ceilings, and hide in corners, and circle about columns in fantastic shapes. It is a smithy, but a smithy adapted, by its extraordinary neatness, to the manufacture of watch-springs, palate-arbors, and Damascus blades.

The faces of the students are aglow with the flush of health-giving exercise; their brows are "wet with honest sweat," their heart-beats are full and strong, and the crimson life-currents surge hotly through every vein to their very finger-tips. They strike out the anvil chorus in all the keys and in every measure of the scale, and the burning sparks fly whizzing through the air.

At a sign from the instructor there is a pause. The students stand at ease and the work is inspected. This is the time for more questions if any student is in doubt; and the rest of five minutes affords opportunity for a brief lecture on the subject of the early history of the fraternity of smiths.

Mythology gives the highest place in its pantheon to Vulcan, the God of Fire. For notwithstanding he is represented as bearded, covered with dust and soot, blowing the fires of his forges and surrounded by his chief ministers, the cyclops, he is given Venus to wife and made the father of Cupid. Among the Scythians the iron sword was a god. When Jerusalem was taken by the Babylonians they made captives of all the smiths and other craftsmen of the city—a more grievous act than the thousand million dollar tribute levied upon France by Germany at the close of the war of 1870. For to be deprived of the use of iron is to be relegated to a state of barbarism.

The vulgar accounted for the keenness of the first sword-blades on the score of magic, and the praises of the smiths who forged were sung with the chiefs of chivalry who wielded them. So highly was this mysterious power regarded by Tancred, the crusader, that in return for the present of King Arthur's sword, Excalibar, by Richard I., he paid for it with "four great ships and fifteen galleys."

The smith was a mighty man in England in the early time. "In the royal court of Wales he sat in the great hall with the king and queen, and was entitled to a draught of every kind of liquor served." His person was sacred; his calling placed him above the law. He was necessary to the feudal state; he forged swords "on the temper of which life, honor, and victory in battle depended." The smith, after the Norman invasion, gained in importance in England. He was the chief man of the village, its oracle, and the most cunning workman of the time. His name descended to more families than that of any other profession—for the origin of the name Smith is the hot, dusty, smoky smithy, and however it may be disguised in the spelling, it is entitled to the proud distinction which its representatives sometimes seek to conceal.

Mr. Smiles draws the following graphic picture of the versatility of the smith of the Middle Ages:

"The smith's tools were of many sorts, but the chief were his hammer, pincers, chisel, tongs, and anvil. It is astonishing what a variety of articles he turned out of his smithy by the help of these rude implements. In the tooling, chasing, and consummate knowledge of the capabilities of iron he greatly surpassed the modern workman. The numerous exquisite specimens of his handicraft which exist in our old gate-ways, church doors, altar railings, and ornamented dogs and andirons, still serve as types for continual reproduction. He was, indeed, the most 'cunning workman' of his time. But besides all this he was an engineer. If a road had to be made, or a stream embanked, or a trench dug, he was invariably called upon to provide the tools, and often to direct the work. He was also the military engineer of his day, and as late as the reign of Edward III. we find the king repeatedly sending for smiths from the Forest of Dean to act as engineers for the royal army at the siege of Berwick."

But the most signal triumph of the art, both of the smelter and the smith, is found in the famous swords of Damascus, whose edge and temper were so keen and perfect that they would sever a gauze veil floating in the air, or crash through bones and helmets without sustaining injury. These Damascus blades, long renowned in the East, but first encountered by Europeans during the crusades, in the hands of the followers of Mahomet, were made of Indian steel or "wootz." This steel, produced in the form of little cakes weighing about two pounds each, in the neighborhood of the city of Golconda, in Hindostan, was transported on the backs of camels two thousand miles to the city of Damascus, and there converted into swords, sabres, and scimitars.

This smith's work has never been excelled, if equalled. Millions of dollars have been expended in efforts to produce the equal of Indian steel. Among the investigators of the subject the most noted was a Russian general, Anossoff, who died in 1851. His experiments were of a very elaborate and exhaustive character. They occupied a lifetime, and resulted in the establishment of works in the Ural Mountains, on the Siberian border, for the production of Damascus steel by a process of his own invention. After General Anossoff's death the quality of the steel produced at his works deteriorated.

We should treat with reverence these obscure hints of the triumphs of the ancients in certain departments of art as suggestive of like great achievements in other directions, for without a knowledge of types they could neither teach the many what the few knew, nor preserve what they had acquired for the instruction of future ages. All art is the product of a sequential series of ideas, each idea containing the germ of the next; hence the preservation of each idea is essential to progress. The art of printing alone enables man to preserve such a record. It follows presumptively that the art of printing constitutes the predominant feature of difference between the civilization of the moderns and that of the ancients. And it is important to observe that the art of printing is far more necessary to progress in the useful arts than in the so-called fine arts. The ancient temples with their sculptured splendors—the Parthenon, the Jupiter Olympius, and scores of others—remained long to testify to the genius of Phidias, Praxiteles, and their gifted colleagues of the chisel. These souvenirs of Greek genius still serve as models for the architect and the sculptor. It needs no chronicle to prove that they mark the culmination of the fine arts. If the moderns have failed to excel, or even equal them, it is not because their conception, design, or construction involved occult processes. It is rather because there is a limit to the development of the so-called fine arts, and that limit in architecture and sculpture was reached in Greece more than two thousand years ago.

But with the Damascus blade, which typifies the useful arts, it is entirely different. It, too, is in itself a triumph of genius not less pronounced than the Athena of Phidias. But above and beyond this the arts of smelting and forging are so subtile as almost to elude the grasp of analysis. Not only the method of the fabrication of the Damascus blade but the processes involved in the production of the steel entering into its composition—all these are shrouded in impenetrable mystery. It follows that the useful arts are finer than the so-called fine arts. Their processes are more intricate, and hence more difficult of comprehension. To a solution of the questions presented in the course of their study an extended acquaintance with the sciences is essential. The highest departments of the fine arts, so-called, require only a study of the features, figure, and character of man, and of certain visible forms of nature, while the useful arts make incessant demands upon the resources of natural philosophy. The chemist toils in his laboratory, and the botanist and the geologist explore forest, field, and mine in search of new truths, with the single purpose of enlarging the sphere of the useful arts, and so of ministering more effectively to the ever increasing needs of man. Hence there can be no limit to the development of the useful arts except the limit to be found in the exhaustion of the forces of nature.

We should, then, venerate the artisan rather than the artist. Let us invoke the shade of the dusky Indian smelter. See him in the dark recesses of the forest, bending in rapt attention over his furnace, or holding aloft a little lump of his matchless steel. Alas, he is dumb! His secret perished with him. But the Indian smelter and the Damascus smith are kin to all the inventors and discoverers of all the ages. Across continents and seas, over trackless wastes of history—epochs during which ignorance and superstition prevailed and the intellect of man slumbered—the ancient smelter and the ancient smith extend their shadowy hands to the students in this school of the nineteenth century—extend them in token of the fellowship of a common struggle and a common hope of triumph—the struggle after truth, and the hope of the triumph of industry.

The instructor raps on the black-board, and the school-room is at once transformed into a smithy. Again the forge-fires roar, and again the anvils resound under the stroke of the hammer. For half an hour the lesson goes on, and then comes the wind-up, and the several tests of excellence are applied to the completed task of each student. Form, dimensions, finish—these are the tests. The instructor marks the several pieces of work, makes a record of the result, reads the record, and is on the point of dismissing the class when an idea occurs to his mind and he enjoins silence. Taking in his hand a heavy sledge, and resting it on the anvil before him, he says, "This is a baby-hammer, and all the forging we do here is baby-forging. I hope soon to have an opportunity to take you to the great works of Mr. Crane, in this city, and there show you a steam-hammer which weighs a ton striking fifty to one hundred blows a minute—blows, too, that shame the fabled power of Vulcan, the God of Fire. At Pittsburg, Pa., there is an anvil of 150 tons weight which serves for forging with a 15-ton hammer. But the monster steam-hammer is to be found in Krupp's cast-steel works at Essen, Germany. The hammer-head is 12 feet long, 5½ feet wide, 4 feet thick, weighs 50 tons, and has a stroke of 9 feet. The depth of the foundation is 100 feet, consisting of three parts, masonry, timber, and iron, bolted together. Four cranes, each capable of bearing 200 tons, serve the hammer with material."

The steam-hammer was invented in 1837 by James Nasmyth, of England, in response to a demand for a hammer that would forge a steamship paddle-shaft of unprecedented size. The nature of the emergency being presented to his mind, Mr. Nasmyth conceived the idea of the steam-hammer instantaneously, as it were, and at once proceeded to sketch the child of his brain on paper. He was too poor to defray the cost of patenting his invention; nor was he able to procure the necessary funds for that purpose until he had seen in France a hammer made from his own original sketch in operation.

The steam-hammer came rapidly into use, superseding all others of the ponderous sort, increasing the quantity of products and reducing the cost of manufacture by fifty per cent. It was through the steam-hammer only that the fabrication of the immense wrought-iron ordnance and the huge plates for covering ships-of-war of modern times became possible. In the hands of the giant, steam, Mr. Nasmyth's hammer, even if it weigh fifty tons, is susceptible of more accurate strokes than the tack-hammer in the hands of the upholsterer, or the sledge in the hands of the most skilled blacksmith. It crushes tons of iron into a shapeless mass at one blow, and at the next drives a tack, or cracks an egg-shell in an egg-cup without injuring the cup.

Mr. Nasmyth, in 1845, applied the steam-hammer principle to the pile-driver. With this wonderful machine the "driving-block," weighing several tons, descends eighty times a minute on the head of the pile, sending it home with almost incredible rapidity. The saving of time as compared with the old method is in the ratio of 1 to 1800; that is, a pile can be driven in four minutes that before required twelve hours.

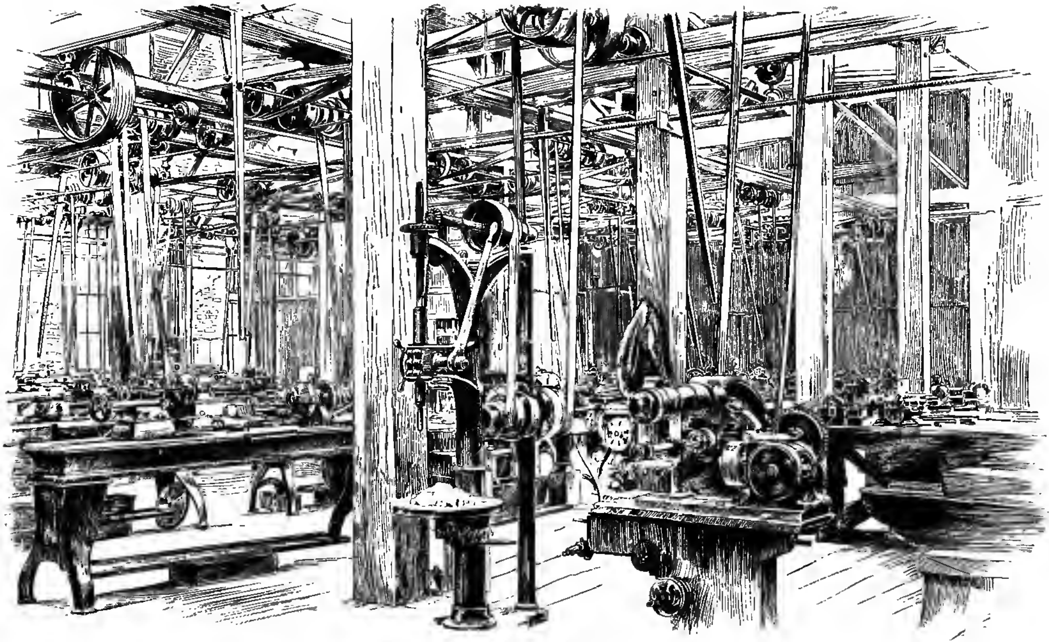
The course in the Forging Laboratory extends from the making and care of forge-fires to case-hardening iron and hardening and tempering steel; and competent and experienced instructors declare that the student in the educational smithy gains as much skill in a day as the smith's apprentice gains in a year in the ordinary shop.

CHAPTER IX.

THE MACHINE-TOOL LABORATORY.

The Foundery and Smithy are Ancient, the Machine-tool Shop is Modern.—The Giant, Steam, reduced to Servitude.—The Iron Lines of Progress—They converge in the Shop; its triumphs from the Watch-spring to the Locomotive.—The Applications of Iron in Art is the Subject of Subjects.—The Story of Invention is the History of Civilization.—The Machine-maker and the Tool-maker are the best Friends of Man.—Watt's Great Conception waited for Automatic Tools; their Accuracy.—The Hand-made and the Machine-made Watch.—The Elgin (Illinois) Watch Factory.—The Interdependence of the Arts.—The Making of a Suit of Clothes.—The Ante-room of the Machine-tool Laboratory.—Chipping and Filing.—The File-cutter.—The Poverty of Words as compared with Things.—The Graduating Project.—The Vision of the Instructor.

The transition from the laboratories for founding and forging to the Machine-tool Laboratory symbolizes a mighty revolution in the practical arts—a revolution so stupendous as to defy description, and so far-reaching as to appall the spirit of prophecy. The foundery and the smithy date back to the dawn of history; the machine-tool shop is a creation of yesterday. About the early manipulations of iron mythology wove a web of fancy: Vulcan forged Jove's thunderbolts, the iron sword of the savage was a god, and even far down the course of time, late in the Middle Ages, Tancred, the crusader, paid an almost fabulous sum for King Arthur's famous sword Excalibar—but the modern machine-tool shop is a huge iron automaton, without sentiment, and possessing no poetry except the rhythmic harmony of motion. In this



THE MACHINE-TOOL LABORATORY.

shop steam is reduced to servitude, and compelled with giant hands to bore, mortise, plane, polish, fashion, and fit great masses of iron, and, anon, with delicate fingers to spin gossamer threads of burnished steel. With the hot steam coursing through its steel-ribbed veins the brain of this automaton thinks the thoughts foreordained by its inventor; its hands do his bidding, its arms fetch and carry for him, its feet come and go at his beck and nod. This automaton feeds on iron, steel, copper, and brass, and produces the watch-spring and the locomotive, the revolver and the Krupp gun, the surgeon's lancet and the shaft of a steamship, the steel pen and the steam-hammer, the vault-lock and the pile-driver, the sewing-machine and the Corliss engine. The lever which wakens this automaton to life, which endows its brain with genius and its fingers with cunning, is the rod of empire. All the lines of modern development converge in the machine-tool shop, and they are all lines of iron, whether consisting of a fine wire strung on poles in mid-air or of huge bars resting on the solid earth. Iron is the king of metals but the slave of man. Its magnetic quality guides the mariner on the sea, and its tough fibre and density sustain the weight of the locomotive on the land. It constitutes the foundation of every useful art, from the plough of the husbandman to the Jacquard loom of the weaver. But it is only in the machine-tool shop that the great steam-driven machines of commerce and manufacture can be produced. The ancients possessed iron, which they cast in the foundery and forged in the smithy; they knew the power of steam, and the magicians of the time amused the populace with exhibitions of it, but they had no machine-tool shops in which steam could be harnessed for the journey across continents and seas. The thousand and one modern applications of iron to the needs of man have originated in the machine-tool shop. It is through these applications of iron, not through iron itself, that human pursuits have been so widely diversified, and human powers so richly developed and enlarged.

The contrasts presented by the development of the useful arts during the last hundred years are startling: The toilsome journey of a day reduced to an hour with the maximum of comfort; the few yards of fabric painfully woven by hand expanded into webs of cotton, linen, woollen, and silk cloths, rolling from thousands of steam-driven looms; the stocking once requiring hours to make, now dropping second by second from the iron fingers of the knitting-machine; the nails, screws, pins, and needles, forged one by one in the old village smithy, now flying from the hands of automatic machines by the thousand million; the numberless stitches of the sewing-machine as compared with the few of the olden time, which made the fingers and the hearts of women ache; the vast crop of cereals planted, cultivated, and gathered into barns with iron hands in contrast with the toilsome processes of even fifty years ago. These are only a few of the many illustrations that might be given of progress in the useful arts, and they all emanate from the machine-tool shop.

At the threshold of the most important inquiry that ever occupied the mind of man stand the twenty-four students we have followed, with more or less regularity, through the various laboratories which constitute the preliminary steps in the manual training course. It is the most important inquiry that ever engaged the attention of man, because it touches modern civilization at more points than any other. It consists of an investigation into the subject of the diversity of the applications of iron in art, a study both of the minute and the ponderous in iron tools and machines, and it is by these tools and machines that the bulk of the great enterprises of the men of modern times are carried forward. These students are familiar with the details of the laboratories for founding and forging, but the manipulations of those branches of iron manufacture are coarse and heavy as compared with those of the Machine-tool Laboratory. In a word, the difference between the iron manipulations of the Machine-tool Laboratory and those of the founding and forging laboratories is the exact measure of the difference between the modern and the ancient systems of civilization.

The ancient civilizations culminated in that of Rome. The Romans possessed iron, but confined their manipulations of it to the foundery and the smithy. Under the Roman empire the enterprises of man—commercial, manufacturing, and industrial generally—reached the limit marked by the applications of iron to the useful arts. It is not important in this connection to inquire why inventions and discoveries ceased. It is enough that they ceased. There was an ominous pause; mankind risen to a giddy height looked back instead of still upward; the struggle to advance came to an end, ambition died out of life, and a saturnalia of bloody crime and savage brutality ensued. Exhaustion followed, then stagnation, moral and intellectual, and then the decay of all the arts. The world stood still, and in that state of quiescence remained until printing was invented and America discovered. Still it waited two hundred and fifty years before receiving the first hint of steam-driven machines and the machine-tool shop, and during all that time progress was painfully slow. Something was required to give to human ambition a grand impulse, and to open to human energy and industry a broad field. That something did not come till the middle of the eighteenth century, and it should never be forgotten that it came then through the humble men of the workshop. To their inventive genius mankind owes more than to all the philosophers, *litterateurs*, professors, and statesmen of all time. These men of the workshop—Huntsman, Cort, Roebuck, Watt, Fulton, Mushet, Hargreaves, Neilson, Whitney, Bramah, Maudslay, Clement, Murray, Roberts, the Stephensons, father and son, and Nasmyth—invented machines which appear to rival human intelligence, and in fact far excel human precision in the execution of their work. In endowing iron with the cunning of genius and the terrific power of the fabled cyclops, the modern mechanic has revolutionized the field of human effort, transferring it from the foundery and the smithy to the machine-tool shop. It is here, and here alone, that steam-driven machines can be made. They may be conceived in the mind of a Watt or a Stephenson, but they can be made only by the automatic tools of a Maudslay, a Clement, a Bramah, or a Nasmyth. Man was helpless without steam-driven machines, and he could not have steam-driven machines until machine-made tools had been devised with which to make them. The experience of Watt strikingly illustrates this point. When he had completed his invention of the steam-engine, he found it nearly impossible to realize his idea in a working machine, owing to the incompetency of the workmen of the time. In reply to the inquiry of Dr. Roebuck, "What is the principal hinderance in erecting engines?" he responds, "It is always the smith-work." His first cylinder, made of hammered iron soldered together by a whitesmith, was a complete failure. But even such workmen were so scarce that upon the death of this "white-iron man" Watt was reduced almost to a state of despair. "His next cylinder was cast and bored at Carron, but it was so untrue that it proved next to useless. The piston could not be kept steam-tight, notwithstanding the various expedients which were adopted of stuffing it with paper, cork, putty, pasteboard, and old hats." Smeaton, the best workman of the time, "expressed the opinion, when he saw the engine at work, that notwithstanding the excellence of the invention it could never be brought into general use because of the difficulty of getting its various parts manufactured with sufficient precision." Watt constantly complained of "villanous bad workmanship." "Machine-made tools were unknown, hence there were no good tools. Attempting to run an engine of the old regime, the foreman of the shop gave it up in despair, exclaiming, "I think we had better leave the cogs to settle their differences with one another; they will grind themselves right in time." Contrast with this clumsy machine of the hand-tool era the Corliss engine of the present day, whose every movement possesses the noiseless grace of a woman and the conscious power of a giant; and this giant springs full-armed from the machine-tool shop as Minerva sprang from the brain of Jupiter. Mr. Smiles says, "When the powerful oscillating engines of the *Warrior* were put on board that ship, the parts, consisting of some five thousand separate pieces, were brought from the different workshops of the Messrs. Penn & Sons, where they had been made by workmen who knew not the places they were to occupy, and fitted together with such precision that so soon as the steam was raised and let into the cylinders the immense machine began as if to breathe and move like a living creature, stretching its huge arms like a new-born giant; and then, after practising its strength a little, and proving its soundness in body and limb, it started off with the power of above a thousand horses, to try its strength in breasting the billows of the North Sea."

The great and small tools, the automata of the machine-shop, are no less triumphs of mechanical genius than the "powerful oscillating engines of the *Warrior*." The prime difficulty of the hand-worker was to make two things exactly alike, then followed the impossibility of making *many* things—the narrow limit of human capacity to produce. At that point the inventor appeared with a machine which would make a thousand things in the time the hand-worker required to make one, and each one of them the exact counterpart of every other.

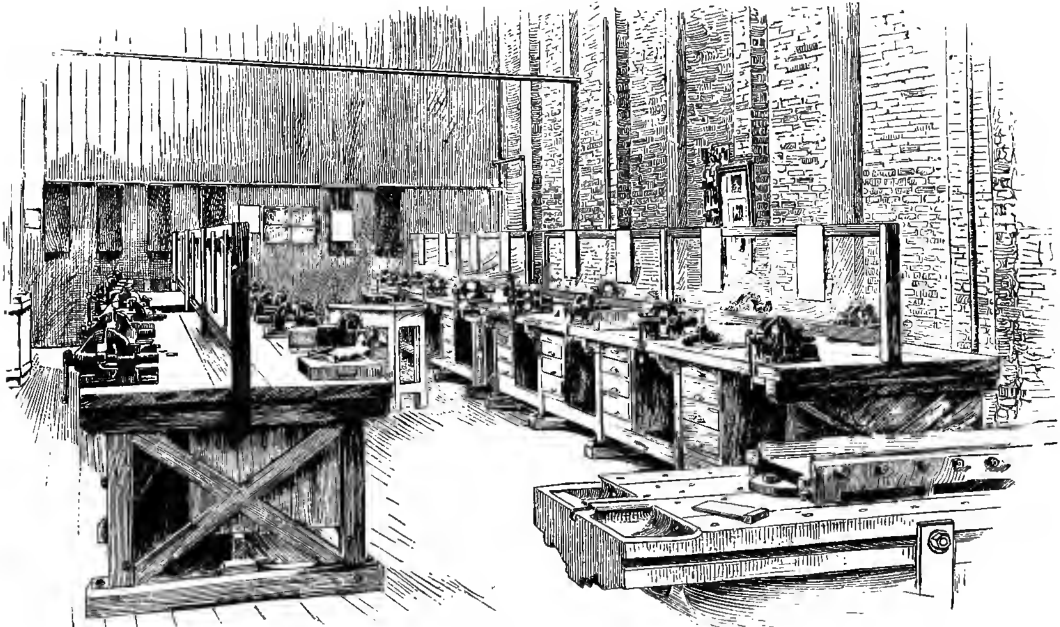
A hundred years ago John Arnold, the inventor of the chronometer, accomplished a marvel of patience and ingenuity in the form of a watch the size of twopence and the weight of sixpence. The workmanship was so delicate that he was compelled not only to fashion every part with his own hand, but to design and make the tools employed in its construction. The watch was presented to George III., of England, who showed his appreciation of Arnold's mechanical skill in a present of five hundred guineas. The Emperor of Russia offered Arnold $5000 for a duplicate of the wonderful little time-piece, which offer was, however, declined. It was so difficult for the expert watch-maker of a century ago to make two things exactly alike, that Arnold could not afford to undertake to make another miniature watch even for the exorbitant price of $5000. But for ten dollars the Elgin (Illinois) National Watch Company will supply the Emperor of Russia with a machine-made watch more nearly perfect than Arnold's masterpiece, and on the same day turn out one thousand others exactly like it. Imagine yourself now in the watch factory of the Elgin Company; observe that artisan holding in his hand a coil of fine steel wire weighing a pound. He approaches a machine, places one end of the wire in its iron fingers, presses a lever, and in a few minutes the coil is converted into two hundred thousand minute screws, each and every one as perfect as the best that Arnold made for his George III. gem.

It is with the greatest effort of painstaking care that the expert sewing-woman draws two stitches closely resembling each other, yet while she is making the toilsome exertion of her utmost skill the sewing-machine sets hundreds of stitches so exactly alike that a microscopic examination would fail to detect the least dissimilarity.

The sewing-machine affords an admirable illustration of the interdependence of the practical arts. The sewing-woman was able to keep pace with the slow and toilsome processes of the distaff and loom, but upon the application of steam-power to spinning and weaving the demand for sewing was augmented a thousand-fold. If the sewing-machine has not emancipated woman from the drudgery so pathetically depicted by Tom Hood, it has multiplied the production of garments almost beyond the power of figures to express. Note this instance illustrative of the triumph of automatic machinery in its application to manufactures. "The Emperor of Austria was lately presented with a suit of clothes possessing this remarkable history: The wool from which the garments were made was clipped from the sheep only eleven hours before the suit was completed. At 6.08 in the morning the sheep were sheared; at 6.11 the wool was washed; at 6.37 dyed; at 6.50 picked; at 7.34 the final carding process was finished; at eight o'clock it was spun; at 8.15 spooled; at 8.37 the warp was in the loom; at 8.43 the shuttles were ready; at 11.10 seven and three-fourth ells of cloth were completed; at 12.03 the cloth was fulled; at 12.14 washed; at 12.17 sprinkled; at 12.31 dried; at 12.45 sheared; at 1.07 napped; at 1.10 brushed; and at 1.15 prepared and ready for the shears and needle. At five o'clock the suit, consisting of a hunting-jacket, waistcoat, and trousers, was finished."

There is a sort of anteroom to the Machine-tool Laboratory with which the students are thoroughly familiar. It is called the Chipping, Filing, and Fitting Laboratory, has twenty-four vises, a great assortment of cold-chisels and files, and is devoted to vise work. The course in the Chipping Filing and Fitting Laboratory consists of a score or more lessons involving various file and chisel manipulations, as, "filing to line," "dovetailing," "parallel fitting tongues and grooves," "ring-work and free-hand filing," "chipping bevels," "ward-filing and key-fitting," "screw-filing," "scraping," etc., each lesson being so devised as to insure the introduction of variously shaped tools, and their application to the forms of work for which they are designed.

This anteroom to the Machine-tool Laboratory is like most anterooms plain in its appointments, and it is also like the conventional anteroom, a place where the student does not desire to remain long. The witchery of the great laboratory beyond has already cast its spell over the boy



THE CHIPPING, FILING, AND FITTING LABORATORY.

at the vise. But there is excellent hand and eye training work in the Chipping, Filing, and Fitting Laboratory.

The file is a humble tool, but it is older than history, dating back to the Greek Mythological period. "From the smallest mouse-tail file used in the delicate operations of the watch and philosophical instrument maker, to the square file for the smith's heaviest work, there is a multifarious diversity in shape, size, and gauge of cutting." Some of the files made by the Swiss for the watch-maker "are of so fine a cut that the unaided eye cannot discern the ridges."

In no department of the useful arts did the handworker attain to greater dexterity than in file-cutting. With a sharp-edged chisel the file-cutter made from one hundred and fifty to two hundred "burs" a minute, and they were so fine as to be traced by the sense of touch alone, but as straight as though ruled by a machine. The hand-working file-cutter held his ground until 1859, when a Frenchman, M. Bernot, invented a file-cutting machine which entirely superseded the old method of manufacture, reducing the cost of files to one-eighth of their former price.

The lessons in the Machine-tool Laboratory will not be described in detail as in the other shops. The processes are so delicate and so intricate, and the resulting products in machines so closely approach the marvellous, as to beggar description. The poverty of words as compared with things asserts itself with unexampled force in the presence of a great variety of tools, each of which seems to be endowed with the power of reflection, and each of which, instead of whispering a word in your ear, drops into your hand a thing of use to man.

The laboratory is silent, the tools are dumb, but how eloquently they proclaim the era of comfort and luxury! They have no tongue, but through their lips you shall speak across continents and under seas. They have no legs, but through their aid you shall, in a race round the world, outstrip Mercury. The machines they make shall bear all your burdens; with their brawny arms they lift a thousand tons, and with their fingers of fairy-like delicacy pick up a pin; with the augur of Hercules they bore a channel through the mountain of granite, and with a Liliputian gimlet tunnel one of the hairs of your head.

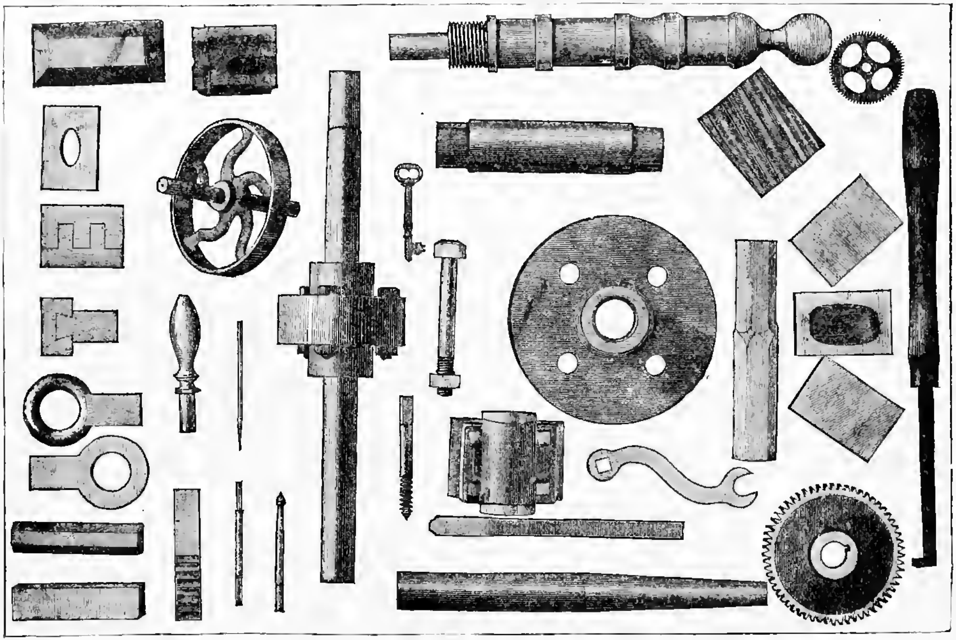
These ingenious tools are worthy of careful inspection both on account of the marvels they perform and the delicacy of their construction and adjustments. One of them, a screw-engine lathe, for example, is taken to pieces, and each piece described in order that the students may be made familiar with the construction of the tool, and so rendered capable of taking good care of it. During this inspection the instructor outlines the history of the tool. The main feature is the slide-rest, invented by Maudslay while in the employ of Bramah, the lockmaker. It is not too much to say that two things exactly alike, or near enough alike, practically, to serve the same purpose very well, were never produced on the old-fashioned turning lathe. This the instructor endeavors to make clear to the class. He also explains precisely how Maudslay's improvement remedied the defects of the old-fashioned lathe. Still there remained something to be done to make it perfect, and putting the pieces together the instructor shows where Maudslay's work ended and that of Clement began. Clement made two improvements in the slide-rest, one involving the principle of self-correction, for which he received the gold Isis medal of the Society of Arts in 1827, and the other consisting of the "self-adjusting double-driving centre check," for which he was awarded the silver medal of the same society in 1828. Thus improved or perfected, the slide-lathe became the acknowledged king of machine-tools, the self-adjusting two-armed driver taking the strain from the centre and dividing it between the two arms, and so correcting all tendency to eccentricity in the work.

The Machine-tool Laboratory contains a great variety of tools, of which the chief are lathes, drills, and planers; but there are many auxiliary tools, and in the advanced stages of the course a single lesson often affords opportunity for the introduction of several of them. And, as in the other school laboratories, each tool, upon its first presentation to the class, forms the subject of a brief lecture—a practical lecture too, for the instructor uses the tool while he sketches its history and perhaps that of its inventor, shows what place it holds in the order of machine-tool development, and how admirably it is adapted to its particular work, and makes suggestions as to its care. Sometimes a lesson involves the use of a drawing made by the students a year before, and the piece of iron in which it is wrought is the product of a previous lesson in forging; and it may also have been manipulated with the file or the cold-chisel, or both, in the Chipping, Filing, and Fitting Laboratory.

From the first lesson in the room devoted to drawing, to the last lesson in the Machine-tool Laboratory, the course of training is orderly, consecutive. Each step contains a hint of the nature of the next step, and each succeeding step consists of a further application of the principles and processes of the last preceding step. In a word, the students follow their drawings through all the laboratories till the designs "are brought out in a finished state either in cast or wrought iron."

The lathe is the fundamental machine-tool, but a completely equipped machine-tool laboratory includes a great variety of supplementary or auxiliary tools, a thorough knowledge of which is essential to a good mechanical education. It does not follow, because these tools are in a large degree automatic, that skill may be dispensed with in their use. Many of them are very complicated in design and construction, and they can no more be made to do efficient service under an unskilled hand than a locomotive can be made to accomplish a series of successful "runs" by an unskilled "driver." Hence every tool in the laboratory is made the subject of an exhaustive study. The principle of mechanics involved in its construction is expounded, a practical illustration of its method of operation is given, its peculiar liability to injury is explained, and rules for its care are carefully formulated, and frequently repeated.

There is a prevalent theory that the wide application of so-called automatic tools to mechanical work largely decreases the legitimate demand for skilled mechanics, but it is fallacious. In the first place a thousand things are now made where one thing was made fifty years ago. In the second place the extensive use of steam and electricity greatly enlarges the sphere wherein accurate work becomes absolutely essential to human safety, and hence extends the field of operations of the inventive faculty. In the third place the cost of machine-tool made products having been greatly reduced, competition is proportionately intensified, thus narrowing the margin of profit, and so rendering any injury to machinery



COURSE IN THE MACHINE-TOOL LABORATORY.

through want of skill in the operator relatively more disastrous. As a matter of fact a fine machine-tool is more liable than a watch to get out of order through careless handling, and it no more than a watch, can be properly repaired by a bungler. It follows that skill in the use of machine-tools is as essential to a successful mechanical career now, as skill in the use of hand-tools was formerly.

But another conclusion follows more irresistably, namely—that the civil engineer who devotes his attention to the construction and management of massive machinery, such as pumps, hydraulic and lever presses, looms, and steam-engines, whether locomotive, marine, or other, must, in order to be master of his profession, be thoroughly familiar with every step of their construction; and such familiarity can only be acquired by a course of practical study in the machine-tool shop. It is the province of the civil engineer to utilize certain forces of nature in the service of man, and it is only through the machine-tool shop that such utilization can be effected. It hence follows that a practical acquaintance with the manipulations of the machine-tool shop is an essential prerequisite to a successful career in the field of higher mechanics. The man who aspires to construct any great mechanical engineering work, like the Brooklyn Bridge, for example, must know the exact mechanical power of every piece of machinery he employs, as also the exact mechanical value of every piece of iron that enters into the structure; and these things he cannot know unless he is familiar with the entire series of iron manipulations, from those of the foundery to those of the machine-tool shop.

The aspect of the Machine-tool Laboratory when in repose, so to speak, is dull and uninteresting, not to say repellant. There are twenty-four engine-lathes, as many adjustable vises, a milling machine, and a variety of auxiliary tools. The lathes are supported by dingy-looking cast-iron frames, and under each lathe there is a chest of drawers containing a set of tools. Overhead there is a wilderness of pulleys and shafting, which seems to the untrained eye to have very little relation to the machines below. The working parts of the lathes show burnished steel surfaces, which reflect coldly the glare of yellow sunlight flooding the room. If it were moonlight instead of sunlight one might summon the ghosts of those daring men who hundreds and thousands of years ago dreamed audaciously of the future of applied mechanics. Roger Bacon must have had a vision of the machine-tool shop when he said, "I will now mention some of the wonderful works of art and nature in which there is nothing of magic, and which magic could not perform. Instruments may be made by which the largest ships, with only one man guiding them, will be carried with greater velocity than if they were full of sailors; chariots may be constructed that will move with incredible rapidity without the help of animals; a small instrument may be made to raise or depress the greatest weights; an instrument may be fabricated by which one man may draw a thousand men to him by force and against their will; as also machines which will enable men to walk at the bottom of seas or rivers without danger."

When steam is "turned on" the aspect of the Machine-tool Laboratory is completely changed. Steam is, indeed, the arch-revolutionist; it breathes the breath of life into inanimate things—makes them think, speak, and act. The low hum of unused machinery first salutes the ear; then the students take their places. They are three years older than when we encountered them in the engine-room. They are from seventeen to twenty years of age. They are no longer boys; they are young men—robust, hearty-looking young men. Their bearing is very resolute—remarkably resolute; their attitude is erect. They are full-chested, muscular-armed, frank-faced young men. In the three years' course now drawing to a close they have learned how to do many things, and hence they show a good degree of confidence. But the dominant expression on all the interesting young faces is, after all, one of modesty; so true is it that every acquisition of knowledge, and especially practical knowledge, not only stimulates desire to learn more, but enlightens the perception as to the magnitude of the field of further inquiry. As the addition of a useful thing to the world's stock of things creates a demand for a score more of useful things, so the addition of a fact to the student's stock of facts not only creates a desire for more facts, but strengthens the mind for the prosecution of the study.

It may be that there are vain statesmen, philosophers, priests, and kings, but we should as little expect to find a vain mechanic as a vain scientist.

These twenty-four students may go out into the world to-morrow to make their way. Some of them will enter upon the stage of active life, others will continue their studies in higher schools of literature, science, and art; but whether they go or stay, if they have made the most of their opportunities in the Manual Training School they have learned the lesson of modesty, and learned to respect labor, not only as a means of earning one's daily bread, but as the most powerful and the most healthful mental and moral stimulant.

Steam is on, and the students standing at the lathes are impatient to begin. It is not a lesson in the ordinary sense. Each student works independently of special direction, for each is engaged in making a machine—the graduating project. The instructor is at hand, not to dictate but to advise, if requested. From his fund of experience as the elder scholar he will answer questions propounded by his younger fellow-students. In front of the students, parts of the working drawings may be seen. It is plain that there is to be variety in the exhibit of "projects." There are several steam-engines, differing in model; there is a steam-pump, a punching machine, a lathe, an electric machine, and a steam-hammer.

At a sign work commences—a dozen varieties of work, emitting a dozen tones of buzzing and whizzing. The instructor's face lights up with a pleased expression as he notes the progress of the work. There is no sign of hesitation in the class; no questions are asked; the students seem to be driving straight to the mark. The instructor's heart swells with pride; he can trust "his boys!" He has been regarding them with an expression of affection, but now his eyes wander—they have a far-away look. He no longer sees the students, he is looking beyond them. He drops into a reclining attitude, sighs, falls into a reverie, and dreams. In his dream he sees naked savages, emerging from caves, armed with clubs, pursuing animals. These are succeeded by men bearing rude stone implements—axes and hammers—and these in turn by men armed with bows and arrows, but half-clothed with skins of beasts, and crouching and shivering beneath the shelter of the branches of a tree pulled downward and secured by clods of earth. This picture disappears, and is replaced by a pastoral scene

—a vast plain covered with flocks and herds. In the foreground stands the shepherd, and in the distance his tent, consisting of skins of beasts stretched on poles, and in the tent door a woman sits pounding a fleece into felt. The shepherd, his flocks and herds, his tent, and the woman in the tent door, vanish like the mists of morning, and where the shepherd was, the husbandman is seen harvesting the golden grain; and in the shadow of the cottage which has replaced the tent a woman is pounding corn. The scene again changes—the plain has become the site of a great city. The city is protected by thick, high walls, surmounted with frowning battlements. Sentinels pace back and forth along the parapet. Huge helmets protect their heads, and their bodies are clothed in armor. Quivers full of bronze-tipped arrows depend from their shoulders, in their hands they carry long bows, and the clank, clank of their broad, two-edged, bronze swords breaks the dull, monotonous routine of their march. A brazen gate swings back noiselessly on brazen hinges, and bowing to the sentinel, the dreamer as noiselessly glides into the city. Suddenly he feels the hot breath of the foundery furnace-fire, and is blinded by a glare of red light. Shading his eyes he sees dusky forms hurrying to and fro with ladles full of molten metal. Turning away he hears the heavy stroke of the sledge, and looking, beholds a dusty, smoky smithy. The stalwart smith drops the sledge at his side, rests one foot on the anvil-block, and wipes the sweat from his brow; the helper thrusts the cooling iron into the coals, bends to the bellows, and the forge-fire sings. At the sound of a bell the dreamer starts, the old Assyrian city falls into ruins, the ruins crumble into dust, and on this dust another city rises, flourishes, falls, and piles the dust of its ruins. Over a waste of years—twenty centuries—the dreamer's thought flashes, and he stands in the presence of the Alexandrian mechanic-philosopher. He sees Hero in the public street, gazing abstractedly at his condensed-air fountain, and follows him into his shop or laboratory, and observes him curiously as he toys with the model of a queer little steam-engine. "This is the Iron Age, but in its infancy," he exclaims under his breath, as his eyes wander from a fine Damascus blade hanging against the wall to some poor hand-tools lying on the working-bench. "I will speak to this old man," he continues, "and ask him to step into my Machine-tool Laboratory, and see my boys make steam-engines; it will be a revelation to him. Come, old friend — there — look!" And the dreamer looks. Does he see double? The laboratory is unchanged; steam is still on; the whir of machinery and the buzzing sound of steam-driven tools salute the ear, and the students are all busy at their benches finishing parts of "projects" and adjusting them in their places. But there are twenty-four other men—shades of men—in the laboratory. Most of them are old; some are in working clothes, others in full dress, wearing ribbons and orders of merit. Over each student one of these shades bends with an air of absorbing attention. The dreamer recognizes Papin, Fulton, Watt, and Stephenson shadowing the students engaged in the construction of engines. They beckon Hero, and he joins the group, threading his way timidly between the lines of lathes, and looking askance at the rapidly revolving wheels and flying belts. Over the shoulders of other students are seen the faces of Maudslay, Bramah, Clement, Roberts, Whitney, Nasmyth, Huntsman, Cort, Murray, Dudley, Yarranton, Roebuck, and Whitworth, besides several unfamiliar faces.

Suddenly they all gather about a nearly completed project — a stationary engine. They witness the forcing home of the last screw; they see the miniature machine made fast to the bench. Steam is let into the cylinders. The student's flushed face is in sharp contrast with the colorless faces of the group of old men by whom he is surrounded. The piston-rod moves languidly—the machine trembles as if awaking from slumber, the shaft oscillates slowly, then faster, then regularly, like a strong pulse-beat. The project is a success—the first one completed! The student's face turns pale—as pale as the white faces of the old men at his side. They open their lips as if to cheer him, but no sound is heard. He breathes quick—almost gasps; his heart beats loudly; he tries to shout but cannot utter a word. At last he claps his hands! The instructor starts from his chair, rubs his eyes, and stares around the laboratory. All the students are there, gathered in a group about the finished "project," but the ghostly shades of the old inventors have vanished like the unsubstantial fabric of a vision.

The "projects" are not all finished on the same day. Some of them are far more complicated than others, and some students are more skilled than others. All are very busy. It is not improper to ask questions relating to work on the graduating projects; the instructor is at hand to answer such questions. But it is a point of honor not to ask a question if the difficulty can possibly be otherwise overcome. Hence very few questions are asked.

The last week of the term is a very trying one to all concerned. The students are reticent and unusually silent; all are anxious, some are timid—the nervous tension is extreme. The instructor becomes taciturn under a painful sense of compulsory isolation from his class, towards all the members of which he has, for three years, sustained fraternal rather than dictatorial relations. But as the projects are, one by one, completed, the atmosphere clears. When the student realizes that his project is certainly not to be a failure, his face lightens and he is pleased to discuss its "points" with the instructor. The instructor is delighted to resume his former relations with the class, the feeling of constraint is dispelled, and the graduation-day exercises are contemplated with confidence.

CHAPTER X.

MANUAL AND MENTAL TRAINING COMBINED.

The new Education is all-sided — its Effect.—A Harmonious Development of the Whole Being.—Examination for Admission to the Chicago School.—List of Questions in Arithmetic, Geography, and Language. — The Curriculum. — The Alternation of Manual and Mental Exercises. — The Demand for Scientific Education — its Effect.—Ambition to be useful.

We have now passed in review all the school laboratories, from the engine-room, or laboratory where power is generated, to the Machine-tool Laboratory where power is utilized, or harnessed, and compelled to do the work of man. We have observed the student, in his first effort over the drawing-board, struggling laboriously to make a straight line, and in the Laboratory of Carpentry, trying with varying success to make a tenon fit the mortise, and we have stood by his side in the Machine-tool Laboratory in the moment of his triumph exhibiting his graduating "project"—a miniature engine throbbing under the pressure of steam, and doing its work with admirable precision. But we have seen only the manual side of the curriculum. The mental side is still to be shown. The claim made in behalf of the new education is that it is better balanced than the old, that it is all-sided, that it produces a harmonious development of the whole being, that it makes of the student a man fully furnished for the battle of life, mentally, morally, and physically. Accordingly the curriculum of the Manual Training School combines with the laboratory exercises a variety of mental exercises of quite a comprehensive character; and first, certain mental acquirements are necessary to admission, as witness the following from the first catalogue of the Chicago school:

"Candidates for admission to the first year must be at least fourteen years of age, and must present sufficient evidence of good moral character. They must pass a satisfactory examination in reading, spelling, writing, geography, English composition, and the fundamental operations of arithmetic as applied to integers, common and decimal fractions, and denominate numbers. Ability to use the English language correctly is especially desired."

The following questions were used at the first examiation for admission to the Chicago school.

ARITHMETIC.

Transcribe work sufficient to show processes. No credit given for results alone.

1. Change to decimals and find the sum of $\frac{4}{5}$, $\frac{5}{8}$, $\frac{11}{16}$, $\frac{9}{20}$, $\frac{41}{50}$.

2. Divide the product of $28\frac{5}{7}$ and $13\frac{4}{9}$ by the difference of $8\frac{5}{12}$ and $4\frac{4}{5}$.

3. Divide .00875 by $12\frac{1}{2}$.

4. Reduce .395 of a mile to integers.

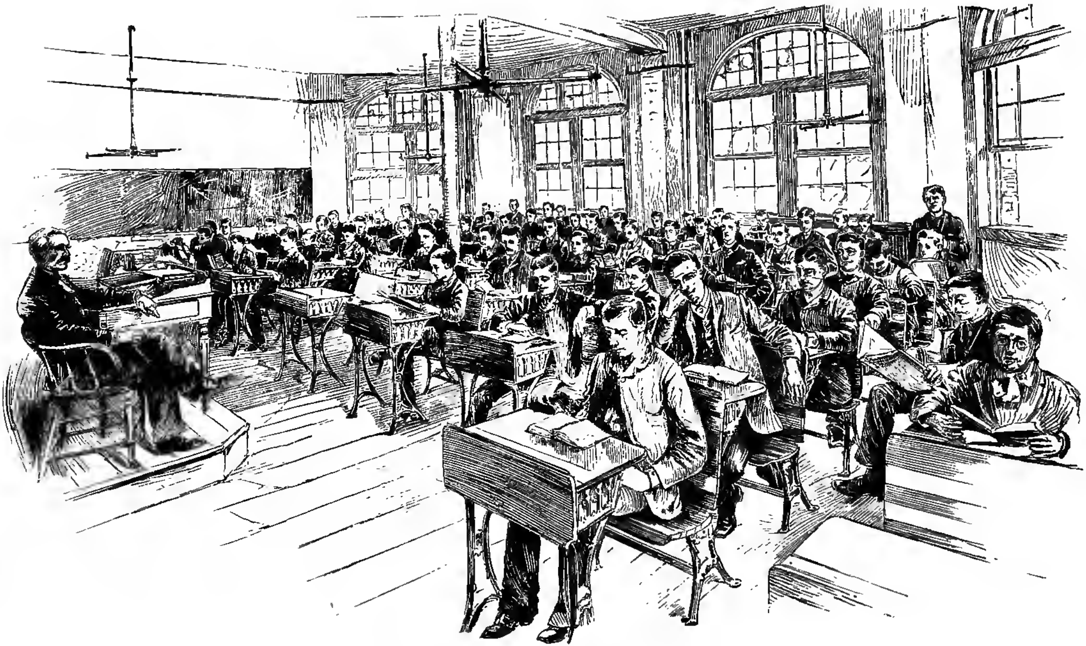
5. If a locomotive move $\frac{5}{8}$ of a mile in $\frac{11}{12}$ of an hour, what is its speed per hour?

6. A man invested $\frac{1}{5}$ of his money in land, .125 of it in stocks, \$12,000 in a vessel, and had \$55,500 remaining. How much did he invest in land?

7. Bought a square mile of land at \$75 an acre. I reserved 160 acres of it for streets and alleys, and divided the remainder into lots each 66 feet front by 200 feet deep, all of which I sold for \$15 per front foot. The expense of surveying, etc., was \$2000. What did I gain?

8. How many balls, each $\frac{1}{4}$ of an inch in diameter, are equal in weight to a ball of the same material 1 foot in diameter?

9. Find cost of material for making box, inside measurement 4 by



THE STUDENTS WITH THEIR BOOKS.

2 by 3 feet, of inch lumber, worth $30 per M., $\frac{1}{25}$ of the lumber purchased being wasted. Include in the cost 7 dozen screws at $1.80 per gross.

10. What is the height of a rectangular cistern capable of containing 600 gallons, the bottom of which is 7 by 11 feet, inside measurement?

GEOGRAPHY.

1. Name the five most populous cities of the United States in order of population. On what water is St. Petersburg? Dublin? Rome? Calcutta? Cairo?

2. Locate the principal coal fields and iron regions of the United States. What minerals occur in Illinois?

3. Draw map of Illinois, showing by what States and by what waters bounded. Locate the capital and the largest city of Illinois.

4. Name the outlet of Lake Erie; of Lake Champlain; of Great Salt Lake; of the Black Sea; of Lake Victoria Nyanza.

5. Compare the latitude and climate of Spain and Illinois.

6. How does the island of Great Britain compare in area with the United States, or with any one of the United States which you may mention?

7. How do the Alps compare in height with the Rocky Mountains? Name the highest peak in Europe; in North America; in South America; in the world.

8. How does climate vary with altitude above the sea level? Illustrate by an example.

9. What is the cause of day and night? Of changes of seasons? What is latitude? Longitude?

10. When it is 11 A.M. by "Central Time" in Chicago, what is the hour by "Eastern Time" in New York City? What is the hour in London? Is "Central Time" in Chicago the true time? Why?

Or, in place of the last question: What are the termini of the Illinois and Michigan Canal? What waters are connected by the Suez Canal? Of what water route does the Suez Canal take the place?

LANGUAGE.

1. Correct in every particular, and give reason for each correction:
   a. The man which was sick has went to his work.
   b. Every person should attend to their own affairs.
   c. Such expressions sound harshly.

d. Between you and I, this is a real easy examination.

e. The cause of the tides were not wholly unknown to the ancients.

2. "Pleasantly rose next morning the sun on the village of Grand Pré."

How is the idea of the rising of the sun modified?

3. "Flashed all their sabres bare,
Flashed as they turned in air,
Sab'ring the gunners there,
Charging an army, while
All the world wondered."

Change to good prose.

4. State the meaning of each prefix and suffix in the following words: Emigrate; Immigrate; Illegally; Admissible; Thoughtlessness; Affixing.

5. *a.* Why is the final e of "service" retained in "serviceable?"

b. Write the present participle of "befit;" of "benefit." What difference in spelling? Why?

c. Define Ancient; Venerable; Obsolete.

6. Write an essay on Chicago, mentioning the rapid growth of the city; its land and water communications; its commerce and manufactures; its public buildings; its institutions of learning and charity, and any other items which may occur to you.

Having passed the ordeal of the foregoing battery of questions the student of the Chicago Manual Training School finds his mental exercises alternated with manual exercises throughout the entire course in something like the following order, namely:

First Year.—Arithmetic, Algebra, English Language, History, Physiology, Physical Geography, Free-hand and Mechanical Drawing. *Laboratory Work:* Carpentry, Wood-carving, Wood-turning, Pattern-making, Proper Care and Use of Tools.

Second Year.—Algebra, Plane Geometry, Physics, Mechanics, History, Literature, Geometrical and Mechanical Drawing. *Laboratory Work:* Moulding, Casting, Forging, Welding, Tempering, Soldering, and Brazing.

Third Year.—Geometry, Plane Trigonometry, Book-keeping, Literature, Political Economy, Civil Government, Mechanics, Chemistry, Machine and Architectural Drawing. *Machine-tool Laboratory Work*, such as Chipping, Filing, Fitting, Turning, Drilling, Planing, etc. Study of Machinery, including the Management and Care of Steam-engines and Boilers.

Latin may be taken instead of English Language, Literature, and History. Instruction will be given each year in the properties of the materials—wood, iron, brass, etc.—used in that year.

Throughout the course, one hour per day, or more, will be given to drawing, and not less than two hours per day to laboratory work. The remainder of the school day will be devoted to study and recitation. Before graduating, each pupil will be required to construct a machine from drawings and patterns made by himself. A diploma will be given on graduation.

The new education is a blending of manual and mental training. It recognizes the fact that science discovers and art utilizes, and that these two forces move the modern world.

At present the Manual Training School is a missionary enterprise. Its purpose is to create in the public mind an imperative demand for the incorporation of its scientific methods into the public-school course of instruction.

A vast majority of our people are employed in the useful arts, and distinction in every department of labor now depends upon scientific education. Without technical education or manual training the laborer of the future cannot hope to rise above the grade of a piece of automatic machinery. He falls into the routine of the shop like a cog or lever moved by steam. To avert this dire misfortune our common schools must be made institutions for manual as well as intellectual training. They must inculcate the dignity of labor not by precept merely, but by example. It is not enough that schools of technology, polytechnic institutes, and manual training schools are being established here and there by private subscription. The supply of these classes of education is only a drop in the bucket to the public demand. Technical and manual training must be made part of the general public educational system. In our city high-schools we now fit boys for college. In those schools we must hereafter fit them for the colleges of art. When this shall have become the fashion in education there will be thousands of high-school graduates with a grand passion for mechanical pursuits—boys with more curiosity on the subject of the expansive force of steam than on the subject of "Greek roots;" with more ambition to invent something useful to mankind than to learn how to draw a bill in chancery; with a stronger desire to discover a new secret in electricity than to carry off a prize for the best Latin oration.

CHAPTER XI.

THE INTELLECTUAL EFFECT OF MANUAL TRAINING.

Intelligence is the Basis of Character.—The more Practical the Intelligence the Higher the Development of Character.—The use of Tools quickens the Intellect.—Making Things rouses the Attention, sharpens the Observation, and steadies the Judgment.—History of Inventions in England, 1740–1840.—Poor, Ignorant Apprentices become learned Men.—Cort, Huntsman, Mushet, Neilson, Stephenson, and Watt.—The Union of Books and Tools.—Results at Rotterdam, Holland; at Moscow, Russia; at Komotau, Bohemia; and at St. Louis, Mo.—The Consideration of Overwhelming Import.

THE quality of all civilizations depends upon intelligence and character, or morality, in the order stated; for morality springs from intelligence, not intelligence from morality. This is an axiomatic deduction of historic analysis.* Nor would it be difficult to prove that prac-

* "But if we contrast this stationary aspect of moral truths with the progressive aspect of intellectual truths, the difference is, indeed, startling. . . . These are to every educated man recognized and notorious facts, and the inference to be drawn from them is immediately obvious. Since civilization is the product of moral and intellectual agencies, and since that product is constantly changing, it evidently cannot be regulated by the stationary agent; because when surrounding circumstances are unchanged, a stationary agent can only produce a stationary effect. The only other agent is the intellectual one, and that this is the real mover may be proved in two distinct ways: first, because being, as we have already seen, either moral or intellectual, and being, as we have also seen, not moral, it must be intellectual; and secondly, because the intellectual principle has an activity and a capacity for adaptation which, as I undertake to show, is quite sufficient to account for the extraordinary progress

tical intelligence is more conducive to a high development of morals than mere theoretical intelligence. For is it not true that the nations most skilled in the useful arts are most highly cultured in morals? And if it be true, it constitutes a potential argument in support of joining to intellectual instruction in the schools a course of training in the elements of the useful arts. And of the fact which forms the basis of this argument there is a logical explanation.

Nothing stimulates and quickens the intellect more than the use of mechanical tools. The boy who begins to construct things is compelled at once to begin to think, deliberate, reason, and conclude. As he proceeds he is brought in contact with powerful natural forces. If he would control, direct, and apply these forces he must first master the laws by which they are governed; he must investigate the causes of the phenomena of matter, and it will be strange if from this he is not also led to a study of the phenomena of mind. At the very threshold of practical mechanics a thirst for wisdom is engendered, and the student is irresistibly impelled to investigate the mysteries of philosophy. Thus the training of the eye and the hand reacts upon the brain, stimulating it to excursions into the realm of scientific discovery in search of facts to be applied in practical forms at the bench and the anvil.

The history of invention and discovery in England affords a striking confirmation of the truth of the proposition that mechanical investigation, with tools in hand, stimulates the intellectual faculties to the highest point

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that, during several centuries, Europe has continued to make."—Buckle's "History of Civilization," Vol. I., p. 130. D. Appleton & Co., 1864.

of activity and excellence. The germs of nearly all the great inventions in mechanics, the benefit of which the world is now enjoying in such ample measure, are directly traceable to the workshops of Great Britain during the period 1740–1840.

England had then no popular system of education, and the apprentices in her shops were poor, obscure, and, at the start, illiterate. But to those poor apprentices the honor of the great inventions and discoveries of that age is almost wholly due. And it is a notable fact that in the struggle to invent tools and machines, to master the art of mechanism, to steal from Nature her secret forces, and harness and use them for the benefit of mankind, the toiling workers not infrequently became highly educated, intellectual giants, familiar not alone with special studies, but masters of many branches of learning.

In 1770 the Russian Government, aware of the inferiority of English iron, and deeming Russian iron essential to England, directed the price of iron for export to be raised three hundred per cent. This arbitrary act stimulated invention. Henry Cort, the son of a brick-maker, entered upon a series of experiments, with a view to the improvement of English iron. They occupied several years, and were of a very expensive character—so expensive as eventually to bankrupt the man who made them. They were, however, so successful as to constitute a splendid epoch in the history of metallurgy. In 1786 Lord Sheffield declared that Cort's improvements in iron, and the steam-engine of Watt, were of more value to Great Britain than the thirteen colonies of America; and in 1862 it was estimated that those improvements had added three thousand million dollars to the wealth of England alone, to say nothing of the rest of the world of iron manufacture throughout which they had been applied. But the only estate secured by this great man as a reward of his genius and a life of toil, as his biographer pathetically remarks, was "the little domain of six feet by two in which he lies buried in Hampstead churchyard."

In 1715 Sheffield contained two thousand inhabitants, of whom one-third were beggars. Its manufactures consisted of jews-harps, tobacco-boxes, and knives. Sheffield is now the chief seat of the steel manufacture of the world. The initial step in this great transformation scene was taken by Benjamin Huntsman. He was born in 1704, and bred to a mechanical calling. The early years of his life were spent in the occupation of clock making and repairing. He was shrewd, observant, and practical, and he gradually extended the scope of his profession to repairing, and finally to making hand-tools. In this branch of his trade he detected defects in the German steel in common use. He removed from Doncaster to Sheffield, and there in the privacy of his cottage studied metallurgy, and for years labored in secret over the furnace and the crucible. His numerous failures were subsequently found chronicled in masses of metal, in various stages of imperfection, buried in the earth. But when he emerged from his long seclusion he offered to his fellow-mechanics a piece of cast-steel so hard that they declined to work it. He sent the product of his works to France, and the French knives and razors made from it and imported into England drove the Sheffield cutlery from the market. Then the Sheffield cutlers sought to have the export of steel prohibited. Failing in that they stole Huntsman's secret. This was possible, since the process had not been patented. The story of the theft is told in a little work entitled "The Useful Metals and their Alloys." It is in substance that one Walker, an iron-founder, "disguised himself as a tramp, and feigning great distress and abject poverty, appeared shivering at the door of Huntsman's foundery late one night when the workmen were about to begin their labors at steel-casting, and asked for permission to warm himself by the furnace-fire." He was permitted to enter, and when he left he carried away the secret of the inventor of cast-steel.

Huntsman was a member of the Society of Friends, and it was doubtless on that account that he declined a membership of the Royal Society tendered to him in honor of his great discovery or invention of cast-steel.

David Mushet's discovery of the extraordinary value of black-band iron-stone in 1801 made Scotland a first-class iron-producing country; and Neilson's invention of the hot-blast in 1828 revolutionized the processes of iron manufacture by vastly cheapening them. Both these men sprang from the labor class, and both were self-educated. Through almost superhuman efforts they rose from poverty and obscurity to fame. Mushet's "Papers on Iron and Steel," in the language of Smiles, "are among the most valuable original contributions to the literature of iron manufacture that have yet been given to the world;" and Neilson was made a member of the Royal Society in recognition of his distinguished ability and the great services he rendered in the cause of the useful arts.

George Stephenson rose from the coal-mine to the summit of renown as a theoretical and practical mechanic. While employed in various collieries as "fireman" and "plugman," he acquired a thorough knowledge of the engines then in use, taking them apart, repairing, and putting them together again. At eighteen years of age he could not read. In the course of two years attendance at night-schools he learned to read, write, and cipher.* Continuing to work in collieries, he employed his leisure hours in studying mechanics and engineering, and in mending clocks and shoes. When thirty-one years of age he was appointed "enginewright" at Killingworth Colliery, at a salary of £100 a year. From this point of time dates his career as an inventor. His first locomotive was completed in 1814, and the "Rocket" made its trial trip in 1829. During the intervening fifteen years Stephenson was largely engaged in the engineering department of railway enterprises as well as in the prosecution of experiments for the perfecting of locomotive engines. The most eminent engineers of the time doubted the practicability of the locomotive, and continued to recommend stationary engines, while Stephenson was leading up to the "Rocket." The success of the "Rocket" made its inventor the most famous mechanic in the world. For the next fifteen years he was the leading spirit in all the great railway enterprises of England, be-

* "In conclusion, we are of opinion that special instruction which can be applied to the material would be at once more fruitful in good results and more attractive if the pupil could go from the class-room to the workshop (laboratory) to practically demonstrate the theories to which he has just been listening. In support of this opinion we might add the observations made in our own evening-schools, where the most noteworthy and rapid progress is made in those cases where the pupil has occasion to put into actual practice on the material itself the instruction which he has received in the drawing-class."—"Report of Committee of Council of Arts and Manufactures of the Province of Quebec, created to Inquire into the Question of Practical Schools."

sides being called repeatedly to Belgium and Spain as consulting engineer. He was offered a fellowship of the Royal Society, also one in the Civil Engineers' Society, also knighthood by Sir Robert Peel. All these empty honors he declined. "I have to state," he said, in reply to a request for his "ornamental initials," "that I have no flourishes to my name, either before or after, and I think it will be as well if you merely say George Stephenson." He may justly be styled the founder of the existing railway system of the world, which undoubtedly exerts more influence upon civilization than any other one cause or set of allied causes; and to have risen from the humblest station in a colliery to the dignity of founding such a system is sufficient evidence of a gigantic intellectual growth.

James Watt was an extremely fragile child, and hence unable to join in the rude sports of robust children. Thus confined within-doors he early amused himself by drawing "with a pencil upon paper, or with chalk upon the floor." He was also supplied with a few tools from his father's carpenter's shop, "which he soon learned to handle with considerable expertness." Mr. Smiles, in his biography of Watt, says, "The mechanical dexterity he acquired was the foundation upon which he built the speculations to which he owes his glory, nor without this manual training is there the least likelihood that he would have become the improver and almost the creator of the steam-engine."* In the parrot-power of learning or mem-

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* "I believe that well-advised practice in any of the constructive arts involving not more than one-third of the student's time will yield as much mental improvement as will result if the whole time be devoted to study from text-books."—Prof. Wm. F. M. Goss, six years

orizing Watt was a dull boy, and he left the grammar-school of his native town at an early age, never to return to the "halls of learning." But while engaged in humble mechanical employments he perfected his education, studying after work-hours. He nearly starved his body, but constantly added to his intellectual stores. He mastered the principles of engineering, civil and military, studied natural history, criticism, art, and acquired several modern languages. In a word, without the aid of the schools, but under the stimulating influence of mechanical investigation and work, Watt became an accomplished and scientific man. When nearly eighty years of age he and Sir Walter Scott met. Referring to the occasion, and speaking of Watt, Sir Walter is reported to have said, "The alert, kind, benevolent old man had his attention alive to every one's question, his information at every one's command. His talents and fancy overflowed on every subject. One gentleman was a deep philologist—he talked with him on the origin of the alphabet as if he had been coeval with Cadmus; another a celebrated critic—you would have said the old man had studied political economy and belles-lettres all his life; of science it is unnecessary to speak—it was his distinguished walk."

These examples of remarkable intellectual development

Director of the Department of Practical Mechanics of Purdue University.

"And reflect that he will learn more by one hour of manual labor than he will retain from a whole day's verbal instructions."—"The Emilius and Sophia" of J. J. Rousseau, Vol. II., p. 64. London: 1767.

"The things themselves are the best explanations. I can never enough repeat it, that we make words of too much consequence; with our prating modes of education we make nothing but praters." —Ibid., p. 46.

in connection with tool-practice are not phenomenal. From the annals of invention and discovery numerous instances might be cited in support of the proposition of this chapter, that tool-practice stimulates intellectual growth.

In the Artisan's School at Rotterdam, Holland, an experience of seven years has demonstrated that "boys who are occupied one-half the day with books in the school, and the remaining half with tools in the laboratories, make about as rapid intellectual progress as those of equal ability who spend the whole day in study and recitation." The testimony of Dr. Woodward, director of the St. Louis (Mo.) Manual Training School, is to the same effect. And in one of his reports he says, "Success in drawing or shop-work has often had the effect of arousing the ambition in mathematics and history, and *vice versa*. . . . The habit of working from drawings and to nice measurements has given the students a confidence in themselves altogether new. This is shown in the readiness with which they undertake the execution of small commissions in behalf of the school. . . . In fact, the increased usefulness of our students is making itself felt, and in several instances the result has been the offer of business positions too tempting to be rejected."

Of the results achieved by the Imperial Technical School, Moscow, Russia, M. Victor Della-Vos, director, speaks with the utmost confidence. He says, "And now (1878) we present our system of instruction, not as a project, but as an accomplished fact, confirmed by the long experience of ten years of success in its results." The methods of instruction of the school at Moscow were introduced into all the technical schools of Russia in 1870.

A similar degree of success has attended the Royal Mechanic Art School at Komotau, Bohemia. The management says, "The school has shown the most brilliant proofs of usefulness, and the ends gained have been acknowledged at home and abroad. One proof is that in spite of the hard times all the pupils from Komotau have found occupation in different manufacturing establishments; and another that England, a country unsurpassed in the manufactures of iron and steel, has already sent some students to the school."

If the pupil in the Manual Training School makes as rapid progress intellectually as the pupil in the public or private school of corresponding grade, it follows that whatever skill in the use of tools is acquired, and whatever knowledge of practical mechanics is gained, these stand for the net gain of the pupil of the new system of education. But much more follows by implication. For if the few pupils of the world's few manual training schools are making equal intellectual progress with the many pupils of the many schools of the old *régime*, and making such progress in a little more than half the study-hours, the consideration of overwhelming import is the loss sustained by the millions of pupils being trained under the old system.

CHAPTER XII.

THE EDUCATION OF WOMEN A PRIME NECESSITY.

The Difference between Ancient and Modern Systems of Education. —Plato Blinded by Half-truths.—No place in the present order of things for Dogmatisms.—Education commences at Birth.—The Influence of Woman extends from the Cradle to the Grave.—The Crime of Crimes—Neglect to educate Woman.—The Superiority of Women over Men as Teachers—Froebel discovered it.—Nature designed Woman to Teach; hence the Importance of Fitting her for her Highest Destiny.

THIS, from the lips of Plato, was the theory of the ancients: "The earth is the common mother of the human race, but it has pleased the gods to mix gold in the composition of some, silver in that of others, iron and copper in that of others."* On this divinely established principle of caste all the ancient educational systems were founded. They were limited to the development of the few in whose composition gold was supposed to be mixed.

The idea of a universal education is modern, and all other differences between the ancients and moderns combined are as nothing to this one fundamental difference between the two civilizations. Plato's ideal republic was based upon the assumption that the "guardians" might be made just and wise by educating them; but that the other classes might also be made just and wise by educa-

* "The Republic of Plato," p. 114. London: Macmillan & Co., 1881.

tion, and the State be so rendered absolutely secure, did not occur to the great philosopher.

Plato was blinded by half-truths, as Rousseau was two thousand years later, when he said, "The poor stand in no need of education; that of their station is confined, and they cannot obtain any other."* That men are created unequal intellectually is only a half-truth in an educational view; the whole truth is that every child is susceptible of the developing influence of education, and hence the obligation of the State to educate relates to all children. Plato's simile of the gold, the silver, and the iron shows how autocratically even the greatest mind is controlled by its environment, and limited by the facts which constitute the basis of its generalizations. Were Plato teaching here, now, he would transpose the order of statement in his simile, since iron, not gold, is the king of metals. Each generation increases the world's stock of facts; hence there is no place in the modern order of things for the dogmatist—the dogmatisms of yesterday become apt themes for the satires of to-day, subjecting their authors to ridicule. This fact should impress upon professional teachers, and upon all persons engaged in seeking to promote the cause of education, the importance of a reverently studious habit of mind touching the progress of events. The tyranny of tradition is an ever-present, potent influence, and only the growing mind can resist it.

But there are certain principles upon which not only ancient and modern educators agree, but about which there is no dispute between existing rival schools, as, for example, this proposition of Plato—

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* "Emilius and Sophia," Vol. I., p. 40. London: 1767.

"The beginning is the most important part, especially in dealing with anything young and tender, for that is the time when any impression which one may desire to communicate is most readily stamped and taken."*

And this proposition of Rousseau—

"The education of a man commences at his birth; before he can speak, before he can understand, he is already instructed. . . . Trace the progress of the most ignorant of mortals from his birth to the present hour and you will be astonished at the knowledge he has acquired."†

And this further proposition, also of Rousseau—

"The common profession of all men is humanity; and whoever is well educated to discharge the duties of a man cannot be badly prepared to fill up any of those offices that have a relation to him."‡

The truth of these propositions being admitted, some conception may be formed of the tremendous influence exerted by woman upon the destinies of the human race. It extends literally from the cradle to the grave. All other influences combined are less potent, less comprehensive than this single, persistent force that creates the very atmosphere in which the infant mind develops, holding the ground alone and undisturbed until the child's plastic character has been formed, receiving ineradicable impressions. What a crime, then, was the neglect of the people of past ages to educate woman! It is in vain that the education of man is attempted if that of woman is neglected. It was Rousseau who in despair exclaimed:

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* "The Republic of Plato," p. 65. London: Macmillan & Co., 1881.

† "Emilius and Sophia," Vol. I., p. 54. London: 1767.

‡ Ibid., Vol. I., p. 13.

"How can a child be properly educated by one who has not been properly educated himself?"

Since, therefore, the education of the man begins while he lies helpless in his mother's arms, and since the first steps in this direction are the most important, and since some sort of education proceeds with almost inconceivable rapidity through all the early years of life, it follows that the kindergarten fills a place in the educational field entirely unoccupied until the time of Froebel. He first applied the ideas of Rousseau to school life. But when the kindergarten receives the child, three or four of the most precious educational years have already passed away, and at the still tender age of seven the child is surrendered to a very different system of training. The kindergarten is therefore only a brief episode in the educational period of the child's life. But if it be the true education, it is susceptible of universal application. Throughout all nature the order of development is constant and harmonious, and the child-nature cannot in reason constitute an exception to this rule. Froebel said, "The end and aim of all our work should be the harmonious growth of the whole being." If his principle is the true one, his method is susceptible of such modification and expansion as to render it applicable to the whole educational period. All mothers should therefore be trained in the principles and methods of the new education — the kindergarten system should prevail in all schools, and the kindergarten curriculum should be extended and adapted to all ages and grades of pupils.

Several great minds, separated by considerable intervals of time, have united in condemning the old systems of education — Bacon, Comenius, Rousseau, Pestalozzi, and Froebel. Bacon, himself a university man, said, "They learn nothing at the universities but to believe;" and he proposed that a college be appropriated to the discovery of new truth, "to mix like a living spring with the stagnant waters." Three of these great men—Comenius, Pestalozzi, and Froebel—were professional teachers. Theoretically they were in accord with and followers of Bacon, and in practice they were substantially agreed. Comenius said, "Let things that have to be done be learned by doing them." Pestalozzi said, "Education is the generation of power," and Froebel said, "The end and aim of all our work should be the harmonious growth of the whole being."

These are very high authorities, and they are buttressed by seemingly impregnable educational propositions. The record of Froebel's life is worthy of great weight in support of his theory. His devotion to the cause of education was absolute. He never knew a selfish aim. He struggled for the race, not for self. He was the victim of many misfortunes, but none disturbed the serenity of this great soul devoted to the greatest of great causes—the cause of education. And education to his apprehension was the thorough training of every faculty of the mind and every power of the body for the duties of actual practical life. His love embraced the world in its entirety and in all its parts. Dying, he said, "I love flowers, men, children, God! I love everything!" It was his profoundly philosophic conception of the innate lovableness of every natural object that made him shudder at the cruel distortion wrought in the natures of little children by false methods of education. Hence his intense devotion to the subject of infant training, and hence the excellence of the system which bears his name.

Froebel's most subtile discovery was the fact of the superiority of women over men, as teachers. Only an honest, brave soul could have made this discovery, for tradition stood like a lion in the way, and prejudice discouraged investigation. But Froebel sought truth for truth's sake, fearlessly defying tradition and ignoring prejudice, and years of experiment convinced him that the greatest measure of success in infant training was surely attainable through women. That this discovery, so simple, yet so big with grand possibilities, was not made earlier is due to the fact that there is so little really independent thought, so little investigation free from the trammels of prejudice. Now that a great mind has pointed the way it is obvious that Nature, having designed that the years of early childhood should be spent with the mother, must have also designed that women should be the chief educators of children. And it follows, of course, that the education of women is more important than that of men, since it is from them that children receive their first impressions, and since first impressions are indelibly stamped upon the infant mind, giving it form, color, and substance.

In confiding to women this great trust, Froebel imposed upon them an incalculable weight of responsibility. It comprehends the destiny of the human race, involving the problem of its progress or retrogression.

A common first conception of the kindergarten is—a convenient asylum for the children of mothers who desire to be relieved of their care. A more thoughtful study reveals its poetry and sentiment, the innocent joy of the assembly of pupils, the harmony of song, and the grace of motion in the games and dances. A final, large view discloses the true educational principle. The kindergarten is more clearly comprehended after studying the manual training school—moving from the effect to the cause; for as the child is father of the man, so the kindergarten is father of the manual training school. The kindergarten comes first in the order of development, and leads logically to the manual training school. The same principle underlies both. In both it is sought to generate power by dealing with actualities. The corner-stone of both is object-teaching—teaching through things instead of through signs of things. This principle, common to both, is the concrete as opposed to the abstract. The theory of both is that, in teaching, ideas should never be isolated from the objects they represent. The kindergarten and the manual training school, being one in principle, should have common methods of instruction, varied sufficiently to adapt them to the whole range of school life.

CHAPTER XIII.

THE MORAL EFFECT OF MANUAL TRAINING.

Mental Impulses are often Vicious; but the Exertion of Physical Power in the Arts is always Beneficent—hence Manual Training tends to correct vicious mental Impulses.—Every mental Impression produces a moral Effect.—All Training is Moral as well as Mental.—Selfishness is total Depravity; but Selfishness has been Deified under the name of Prudence.—Napoleon an Example of Selfishness.—The End of Selfishness is Disaster; but Prevailing Systems of Education promote Selfishness.—The Modern City an Illustration of Selfishness.—The Ancient City.—Existing Systems of Education Negatively Wrong.—Manual Training supplies the lacking Element.—The Objective must take the Place of the Subjective in Education.—Words without Acts are as dead as Faith without Works.

Education, or training, has two immediate and continuous effects—the development of innate mental qualities or aptitudes and the formation of character. In an orderly logical system of training the development would be harmonious, and the resulting formation of character symmetrical. These are, however, ideal conditions requiring a perfect system of training, and students free from the perversions and deformities growing out of the law of heredity. But under any system of training there is progress—development and character formation. The aphorism, "An idle brain is the devil's workshop," expresses only a half-truth. What it means is this: if the brain is not well employed it will be ill employed; or if it is not occupied with good thoughts it will be occupied with evil thoughts. The mind of man is never at rest, in equilibrium, even in a state of barbarism. Indeed this is obvious, since all civilizations are growths sprung from states of savagery. But the barbaric line once passed, development is greatly accelerated, assuming with the evolution of the ages the form of a geometrical progression. The distinguishing characteristic of modern civilization is action. In so far as this action, which may be called the impulsive force of the spirit of the age, is natural and orderly, it constitutes an aid to the processes of education; if otherwise, it is obstructive, hindering them.

The law of mental development is not the exact correlative of the law of physical development. The direct aim of physical training is muscular power; of mental training the aim is mental power and rectitude. Physical power is not intrinsically vicious; it becomes vicious only when exerted under a vicious intellectual impulse. But this is not necessarily true of mental power; for mental power may be gained quite apart from the element of rectitude, in which event it is vicious, and may be exerted in scorn of the accepted standards of right, truth, and justice. As a matter of fact it is often so exerted, and the fact that it is so exerted accounts for the crimes of individuals, the faults of society, and the errors of governments. The constitution of mental power is, then, complex, while that of physical power is simple. If mental power consists of sense perception or understanding and moral perception or rectitude in due proportion, the issue is a noble character; but if rectitude is wanting, the issue is an evil character. If, on the other hand, there is no interference with the orderly development of physical power, the issue of its exertion is always skill—skill applied in innumerable forms to the uses of man. Only through a mental impulse rendered vicious by the absence of the element of rectitude can physical power be diverted from its naturally beneficent mission.

It follows that most of the evils of civilization flow from an ill-balanced mental constitution—a mental constitution wanting the essential element of rectitude. Since, then, mental development, under certain widely prevailing conditions, is so prolific of evil, and physical development or skill so universally prolific of good, it is obvious that the beneficent influence of the latter should, if practicable, be brought to bear upon the former in educational systems. In a word, may not the two systems of training be so connected in the schools as to cause the manual to react upon the mental, with the effect of greatly strengthening the ethical side of the mind?

It is not essential to our purpose to inquire whether a perfect system of education, and hence an ideal state of society, is possible. It will be sufficient if we are able to show wherein pervailing systems of education can be improved.

In a former chapter we sought to show that the use of mechanical tools stimulates the intellect; in the present chapter it is our purpose to endeavor to show that manual training tends to the promotion of rectitude, to the up-building of character.

For purposes of culture the mind consists of divisions, as the body consists of members. It is susceptible of development in the line of the application of mental training, as any member of the body is susceptible of development through physical training or use. For example, the memory may be invigorated by the constant application of certain kinds of mental training, as the arm is strengthened by the constant use of the sledge-hammer. But if the mental training which stimulates the memory is applied to the neglect of other lines of training, the memory will be invigorated at the expense of some other faculty of the mind, as the excessive use of the sledge-hammer strengthens the arm at the cost of other members of the body. In the one case the mind, and in the other the body will be deformed. In the case of the sledge-hammer training the muscles of the arm will stand out like whip-cords, while those of the legs will shrivel and become attenuated. In the case of the training of the memory that faculty will show an abnormal development, while some other faculty, as the power of ratiocination, probably, will become weak.

It is not necessary in this connection to inquire into the origin of moral sentiments, or to consider the rival theories on the subject. However men may differ as between the two schools of moral philosophers — the sentimentalists and the utilitarians—they will agree that the moral side of the mind, so to speak, consists of divisions like the mental side; that these divisions are the source, respectively, of good and evil tendencies, and that these tendencies are susceptible of cultivation; that the evil may be restrained and the good developed, and *vice versa*. Nor will it be disputed that there is such a blending of the moral with the mental nature in the mind of man as to render any consideration of the subject irrational and incomplete which does not comprehend both, and treat them, practically, as one and the same. Man is so constituted, and his relations to society are such, that every mental impression he receives produces a moral effect, the character of which is, of course, largely dependent upon the accepted standards of right, truth, and justice. Hence all scholastic training is both mental and moral. It is moral as well as mental, whether the instructor will it so or not; and that it is moral is well, since it is obviously true, as Galton pertinently remarks, that "Great men have usually high moral natures, and are affectionate and reverential, inasmuch as mere brain without heart is insufficient to achieve eminence."

Selfishness is the arch enemy of virtue; from it all forms of immorality spring, and its last analysis is total depravity. But literature, which is the fruitage of education, is full of maxims in honor of selfishness. Said the Dauphin to the French king, "Self-love, my liege, is not so vile a sin as self-neglecting." Said Herbert, "Help thyself and God will help thee." "A penny saved is as good as a penny earned," said Franklin; and the grasping "Yankee" stretches the maxim a point in saying to his son, "Make money honestly if you can, but make money."

The following, also, are current maxims: "Every man is the architect of his own fortune;" "Every tub must stand upon its own bottom;" "In the race of life the devil takes the hindmost;" "Look to the main chance;" and, "Keep what you have got, and catch what you can." To the same purpose is the famous old aphorism of which Napoleon the First was so fond, "God always favors the heaviest battalions." Emerson declared that Napoleon represented "the spirit of modern commerce, of money, and material power," and he certainly was the very incarnation of selfishness.* He had a hand of iron, and he

* "'God has granted,' says the Koran, 'to every people a prophet in its own tongue.' Paris, and London, and New York, the spirit of commerce, of money, and material power, were also to have their prophet; and Bonaparte was qualified and sent. Every one of the million readers of anecdotes, or memoirs, or lives of Napoleon de-

laid it heavily on all who opposed him. If it became necessary to imprison his enemies he imprisoned them; if it became necessary to kill them he cut off their heads. When charged with the commission of great crimes, he retorted, "Men of my stamp do not commit crimes!" "I have always marched with the opinion of great masses and events," he exclaimed, with the insolence of a butcher exhibiting his bloody hands. Old-fashioned codes of morals were for those who opposed his plans, not for him. But the end of selfishness is disaster. It is as dangerous to assume to rise above moral laws as to sink below them; in the one case they crush, and in the other they undermine. "The half" is, after all, "more than the whole," for "the half" may be retained, but "the whole" is sure to slip from the fingers of grasping avarice. Napoleon, who defied both God and man, expiated his crimes on a rock in mid-ocean. There, whining, protesting, and prating of injustice, he died miserably, a colossal example of the folly of selfishness.

Selfishness seeks to wring from society a support without giving to it an equivalent return. What industry creates and saves to society, selfishness seeks to misappropriate to its own use; hence selfishness is in conflict with the true spirit of civilization, which is the compact of all to protect each in his rights. Selfishness caused the destruction of all the governments of ancient times, and it has been the cause of all the revolutions of modern times. There can be no stability in government until altruism takes the place of selfishness in the world's code

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lights in the page, because he studies in it his own history."—"Representative Men," p. 221. Boston: Phillips, Sampson & Co., 1858.

It would be impossible more severely to arraign existing educational methods; for men are what education makes them.

of ethics. The sole condition of the stability of the State is a disposition on the part of its people to conform to justice and correct moral principles in all social transactions.

Any system of education that does not tend to produce a state of morals conformable to this high standard is not merely defective; it is radically wrong, and therefore positively vicious. The true purpose of education is the harmonious development of all the powers of the man—mental, moral, and physical. But harmony in a selfish character is impossible, for selfishness is blind of one eye, so to speak; it considers only one side of a cause—the side that relates to its interest, regardless of all other interests. Let not prudence be confounded with selfishness. Prudence and selfishness are as wide apart as the poles. Extreme prudence is perfectly consistent with entire rectitude, while extreme selfishness is the synonym of depravity; hence the first step in education is to eliminate selfishness from the mind, and the next step is to put rectitude in its place.

Prevailing systems of education no doubt promote the spirit of selfishness:* witness the character of the struggle for self-aggrandizement. It is more intense and more widely extended than at any period of the world's his-

* "In small, undeveloped societies, where for ages complete peace has continued, there exists nothing like what we call Government; no coercive agency, but mere honorary headship, if any headship at all. In these exceptional communities, unaggressive, and from special causes unaggressed upon, there is so little deviation from the virtues of truthfulness, honesty, justice, and generosity, that nothing beyond an occasional expression of public opinion by informally assembled elders is needful."—"Political Institutions," ¶¶ 437, 573; "The Sins of Legislators," in "The Man *versus* the State," p. 44. By Herbert Spencer. New York: D. Appleton & Co.

tory. That it is more intense is shown by the more and more rapid concentration of populations in cities, where the struggle assumes its most intense form, and exhibits itself in its most threatening aspect.

Cities have always been plague-spots on the body politic, and they are not less so now than in ancient times. It is in cities that all dangers to the State originate; and the sole, fundamental reason why cities are a standing menace to the integrity of the social compact is the fact that they are dominated by selfishness. It is in cities that the unnatural, unwholesome desire to live without labor, to live by speculative enterprises, becomes a consuming passion, inoculating with a deeper and darker degree of selfishness an ever-widening circle of people; and selfishness at last inevitably leads to anarchy. It leads to anarchy and chaos because both classes of society become depraved—the rich and powerful through indolence and sensual indulgence, and the poor and wretched through ignorance and privation and their attendant mean vices.

The modern city is the despair of the modern political economist. It grows relatively faster in population than the rural district, and it would be the extreme of optimism to declare that it grows better. It does not matter that the city is the centre of learning, the nursery of all the active intelligences which are achieving fresh triumphs daily in every department of science, literature, and art. It is also the centre of vice, and the nursery of every variety of crime.

The difficulty—nay, the despair—of the situation is not relieved or mitigated by the undisputed fact that the ancient city was much worse morally and politically than the modern city, and hence that as between Rome and

Chicago there is an immense moral and political advantage in favor of the latter. If Chicago is retrograding morally and politically, what is to prevent it from sinking to the moral and political status of Rome under the infamous emperors of the period of its decadence? If the modern American city is rapidly degenerating, both as a moral force and a political institution, what is to arrest its downward progress? What influence is to intervene to reverse the order and nature of its development?

Rome, in the very agonies of political dissolution, possessed all the then known arts, a splendid literature, and a school of philosophy whose ethical code was more lofty, if less human, than that of the new system which was struggling to replace the old. That the inconceivably atrocious gladiatorial games should have developed into such huge proportions in conjunction with the sublime moral teachings of Seneca, Plutarch, Marcus Aurelius, and a score of others, is the despair of students of Roman history. While they taught, emperors and people alike feasted their eyes on bloody orgies of men and beasts, on scenes of the most horrible barbarity. Caligula took special delight in watching the countenances of the dying, "for he had learned to take an artistic pleasure in observing the variations of their agony." Criminals dressed in the skins of wild beasts were thrown to bulls which were maddened with red-hot irons. "Four hundred bears were killed in a single day under Caligula; three hundred on another day under Claudius. Under Nero, four hundred tigers fought with bulls and elephants; four hundred bears and three hundred lions were slaughtered by his soldiers. In a single day, at the dedication of the Colosseum by Titus, five thousand animals perished. Under Trajan the games continued for one hundred and twenty-three successive days. Lions, tigers, rhinoceroses, hippopotami, giraffes, bulls, stags, even crocodiles and serpents, were employed to give novelty to the spectacle."

And yet the civilization that produced these games gave to the world forever the moral precepts of the stoics and philosophers. Cicero had maintained the doctrine of the universal brotherhood of man. "Nature ordains," he says, "that a man should wish the good of every man, whoever he may be, for this very reason: that he is a man." Menander maintained that "man should deem nothing human foreign to his interest." Lucan looked forward to the time when "the human race will cast aside its weapons, and all nations learn to love." In a letter on the death of his slaves Pliny exhibited feelings of strong human affection, and Plutarch, in a letter of consolation to his wife on the death of his daughter, left a touching record of the tenderness of his heart in the recital of a simple trait of the child: "She desired her nurse to press even her dolls to the breast. She was so loving that she wished everything that gave her pleasure to share in the best that she had." Says Seneca, "The whole universe which you see around you, comprising all things both divine and human, is one. We are members of one great body." And Epictetus, "You are a citizen and a part of the world. The duty of a citizen is in nothing to consider his own interest distinct from that of others."

The contrast presented by these noble moral sentiments to the actual life of the Roman people is truly startling. It is plain that the profession of lofty moral sentiments by a class, the possession of high literary attainments, and an extensive acquaintance with the arts, do not always afford protection against national degradation and decay. Nor is it by any means certain that the Christian religion is destined to effect more in this regard than the pagan code of morals. Rome embraced religion, but its conversion was powerless to avert political and commercial destruction.

The modern city has for guides the example of all the ancient civilizations and political and moral systems, and in addition it has in its most vital form the Christian system of morals and faith. But notwithstanding all these helps it is politically corrupt and morally depraved. Its streets are the scenes of vice scarcely less revolting than those of ancient Rome. It harbors an army of criminals which grows with its growth, and is without any systematized effort either to reform or abolish it. Indeed this army of criminals is constantly reinforced in an increasing ratio to the whole population from the ranks of the rising generation, which is to a degree enforced to ignorance by the inadequacy of educational facilities.* Its power to accumulate wealth is increasing, but this power is confined to relatively fewer hands, and this is one of the most alarming features of the situation. For the increase of ignorance, vice, and crime is sure to keep pace with the abnormal growth of estates, stimulated to the highest degree by dishonest business practices and gigantic schemes of speculation.

It does not follow because prevailing methods of edu-

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* In support of the truth of these propositions it is sufficient merely to allude to the late disclosures by the *Pall Mall Gazette* of the prevalence of revolting crimes in London, England. It is also pertinent to remark the attitude of hostility maintained by the higher classes (so called) of the English people towards the editor of the journal in which the disclosures were made, as significant of an alarming degeneration of the moral sense of the British public.

cation promote the spirit of selfishness, and hence contain the seeds of social and moral decay, that they are wholly vicious; but it does follow, if they are not positively wrong, that they are negatively wrong. Let us assume that they are only negatively wrong, that they lack an essential element in all mental and moral training—the manual element; and let us try to discover what would be the effect of the incorporation of this element into the curriculum of the schools.

A system of education consisting exclusively of mental exercises promotes selfishness because such training is subjective. Its effects flow inward; they relate to self. All mental acquirements become a part of self, and so remain forever, unless they are transmuted into things through the agency of the hand.

It is through the hand alone that the mind finally impresses itself upon matter. In other words, thought and speech must be incarnate in things or they are dead. The orator appeals to the people to strike for their rights; the people rend the air with shouts and subside into silence. The orator cries, "To Arms!" Again the people shout, and again subside into silence. The orator's thoughts are of carnage, his words of flames, but they are as dead as if never conceived and uttered because no hand is raised to embody them in deeds.

Manual training, on the other hand, promotes altruism because it is objective. Its effects flow outward; they relate not to self but to the human race. The skilled hand confers benefits upon man, and each benefit so conferred exerts the natural reflex moral influence of a good act upon the mind of the benefactor.*

* "And now I would point out how the occupations of the work-

Morality is not a mere sentiment, a barren ideality. It is true there is a negative morality which consists in refraining from the commission of wrongful acts. But the morality of the great ethical teachers is positive; it consists in doing. Christ said, "Inasmuch as ye have done *it* unto one of the least of these my brethren, ye have done *it* unto me." Words without acts are as dead as faith without works. Paul said, "Though I have all faith, so that I could remove mountains, and have not charity, I am nothing."

Morality is a vital principle whose exemplification consists in doing justice; and justice is that virtue "which consists in giving to every one what is his due; practical conformity to the laws and to principles of rectitude in

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shop and the atelier combined tend to establish in the mind of the pupil an unselfish and impersonal standard of valuation which will prepare him admirably for the truer moral estimate of life. For days, and perhaps for weeks, he labors to convert a formless material into a form illustrating mathematical truth or æsthetic harmony. He undergoes protracted toil, and meets perhaps with many failures and disappointments, in order to be rewarded at last—by what? Simply by realizing in some degree that perfectness of the object which he aimed at from the beginning. His work is devoid of any pecuniary value. It is a mere typical form. Its worth consists in being true or in being beautiful. And a habit is thus formed of judging things in general according to their intrinsic rather than their superficial qualities. Gradually, and almost insensibly, the analogy of the work performed on outward objects will be applied to inward experience. . . . Thus while he is shaping the typical objects which the instructor proposes to him as a task, while he pores silently, persistently, and lovingly over these objects, reaching success by dint of gradual approximation, he is, at the same time, shaping his own character, and a tendency of mind is created from which will eventually result the loftiest and purest morality."—Prof. Felix Adler, *Princeton Review*, March, 1882.

the dealings of men with each other; honesty, integrity in commerce or mutual intercourse." It follows that morality can no more be acquired by memorizing a series of maxims than the art of using tools can be acquired by studying the laws of mechanics and of mechanism.

CHAPTER XIV.

THE MIND AND THE HAND.

The Mind and the Hand are Allies; the Mind speculates, the Hand tests its Speculations in Things.—The Hand explodes the Errors of the Mind—it searches after Truth and finds it in Things.—Mental Errors are subtile; they elude us, but the False in Things stands self-exposed.—The Hand is the Mind's Moral Rudder.—The Organ of Touch the most Wonderful of the Senses; all the Others are Passive; it alone is Active.—Sir Charles Bell's Discovery of a "Muscular Sense."—Dr. Henry Maudsley on the Muscular Sense.—The Hand influences the Brain.—Connected Thought impossible without Language, and Language dependent upon Objects; and all Artificial Objects are the Work of the Hand.—Progress is therefore the Imprint of the Hand upon Matter in Art.—The Hand is nearer the Brain than are the Eye and the Ear.—The Marvellous Works of the Hand.

A PURELY mental acquirement is a theorem—something to be proved. As to whether the theorem is susceptible of proof is always a question until the doubt is solved by the act of doing. Hence Comenius's definition of education—"Let those things that have to be done be learned by doing them"—is profoundly philosophical, since nothing can be fully learned without the final act of doing, owing to the fact of the incompleteness of all theoretical knowledge.

The mind and the hand are natural allies. The mind speculates, the hand tests the speculations of the mind by the law of practical application. The hand explodes the errors of the mind, for it inquires, so to speak, by the act of doing, whether or not a given theorem is demonstrable in the form of a problem. The hand is, therefore, not only constantly searching after the truth, but is con stantly finding it.* It is possible for the mind to indulge in false logic, to make the worse appear the better reason, without instant exposure. But for the hand to work falsely is to produce a misshapen thing—tool or machine—which in its construction gives the lie to its maker. Thus the hand that is false to truth, in the very act publishes the verdict of its own guilt, exposes itself to contempt and derision, convicts itself of unskilfulness or of dishonesty.

There is no escaping the logical conclusion of an investigation into the relations existing between the mind and the hand. The hand is scarcely less the guide than the agent of the mind. It steadies the mind. It is the mind's moral rudder, its balance-wheel. It is the mind's monitor. It is constantly appealing to the mind, by its acts, to "hew to the line, let the chips fly where they may."

Dr. George Wilson says, "In many respects the organ of touch, as embodied in the hand, is the most wonderful of the senses. The organs of the other senses are passive; the organ of touch alone is active. . . . The hand selects what it shall touch, and touches what it pleases. It puts away from it the things which it hates, and beckons towards it the things which it desires. . . . More-

* "In other cases, even by the strictest attention, it is not possible to give complete or strict truth in words. We could not, by any number of words, describe the color of a ribbon so as to enable a mercer to match it without seeing it. But an 'accurate' colorist can convey the required intelligence at once, with a tint on paper."—"The Laws of Feesole," Vol. I., p. 7. By John Ruskin, LL.D. New York: John Wiley & Sons, 1879.

over, the hand cares not only for its own wants, but when the other organs of the senses are rendered useless takes their duties upon it. . . . The blind man reads with his hand, the dumb man speaks with it; it plucks the flower for the nostril, and supplies the tongue with objects of taste. Not less amply does it give expression to the wit, the genius, the will, the power of man. Put a sword into it and it will fight, a plough and it will till, a harp and it will play, a pencil and it will paint, a pen and it will speak. What, moreover, is a ship, a railway, a light-house, or a palace—what indeed is a whole city, a whole continent of cities, all the cities of the globe, nay the very globe itself, so far as man has changed it, but the work of that giant hand with which the human race, acting as one mighty man, has executed his will."*

There is a philosophical explanation of the versatility of the hand so graphically portrayed in the foregoing passage, and it is found in Sir Charles Bell's great discovery of a "muscular sense." The principle of this discovery is that "there are distinct nerves of sensation and of motion or volition—one set bearing messages from the body to the brain, and the other from the brain or will to the body."

In his work on the hand, after reviewing the line of argument which led to his discovery, Sir Charles says, "By such arguments I have been in the habit of showing that we possess a muscular sense, and that without it we could have no guidance of the frame. We could not command our muscles in standing, far less in walking, leaping, or running, had we not a perception of the con-

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* "The Five Gateways of Knowledge," p. 121. By George Wilson, M.D., F.R.S.E. London: Macmillan & Co., 1881.

dition of the muscles previous to the exercise of the will. And as for the hand, it is not more the freedom of its action which constitutes its perfection, than the knowledge which we have of these motions, and our consequent ability to direct it with the utmost precision."*

On the influence of the muscular sense, Dr. Henry Maudsley has these pertinent observations:

"Those who would degrade the body, in order, as they imagine, to exalt the mind, should consider more deeply than they do the importance of our muscular expressions of feeling. The manifold shades and kinds of expression which the lips present—their gibes, gambols, and flashes of merriment; the quick language of a quivering nostril; the varied waves and ripples of beautiful emotion which play on the human countenance, with the spasms of passion that disfigure it—all which we take such pains to embody in art — are simply effects of muscular action. . . . Fix the countenance in the pattern of a particular emotion—in a look of anger, of wonder, or of scorn—and the emotion whose appearance is thus imitated will not fail to be aroused. And if we try, while the features are fixed in the expression of one passion, to call up in the mind a quite different one, we shall find it impossible to do so. . . . We perceive, then, that the muscles are not alone the machinery by which the mind acts upon the world, but that their actions are essential elements in our mental operations. The superiority of the human over the animal mind seems to be essentially connected with the greater variety of muscular action of which man is capable;

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* "The Hand: its Mechanism and Vital Endowments as Evincing Design," p. 151. By Sir Charles Bell, K.G.H., F.R.S., L. and E. Harper & Brothers, 1864.

were he deprived of the infinitely varied movements of hands, tongue, larynx, lips, and face, in which he is so far ahead of the animals, it is probable that he would be no better than an idiot, notwithstanding he might have a normal development of brain."*

It is through the muscular sense that the hand influences the brain. According to Sir Charles the hand acts first. It telegraphs, for example, that it is ready to grasp the chisel or the sledge-hammer, or seize the pen, whereupon the brain telegraphs back precise directions as to the work to be done. These messages to and fro are lightning-like flashes of intelligence, which blend or fuse all the powers of the man, both mental and physical, and inform and inspire the mass with vital force.†

Through constant use the muscular sense is sharpened to a marvellous degree of fineness, and the hand, permeated by it, forms habits which react powerfully upon the mind. If, now, during the period of childhood and youth, the hand is exercised in the useful and beautiful arts, its muscular sense will be developed normally, or in the di-

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* "Body and Mind," p. 32. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1883.

† The goldsmith's art was one of the finest among the ancients, and so continued far into the Middle Ages. The cutting of cameos, for example, required the highest skill and produced the most exquisite results. Mr. Ruskin calls attention to the fact that "all the great early Italian masters of painting and sculpture, without exception, began by being goldsmiths' apprentices;" and that "they felt themselves so indebted to, and formed by, the master craftsman who had mainly *disciplined their fingers*, whether in work on gold or marble, that they practically considered him their father, and took *his* name rather than their own."—"Fors Clavigera," Part III., p. 291. By John Ruskin, LL.D. New York: John Wiley & Sons, 1881.

rection of rectitude, and the reflex effect of this growth upon the mind will be beneficent.

It is thus that the trained hand comes at last to foresee, as it were, that a false proposition is surely destined to be exploded. The habit of rectitude gives it prescience. It invariably discovers, sooner or later, that a false proposition, when embodied in wood or iron, becomes a conspicuous abortion, involving in disgrace both the designer and the maker. A false proposition in the abstract may be rendered very alluring; a false proposition in the concrete is always hideous. One of the chief effects of manual training is, then, the discovery and development of truth; and truth, in its broadest signification, is merely another name for justice; and justice is the synonym of morality.

It has been shown that thought and speech are dead unless embodied in things. It may also be asserted with confidence that man would lose the power of speech almost wholly if his words should cease to be realized in things. Mr. Darwin declares that "a complex train of thought can no more be carried on without the aid of words, whether spoken or silent, than a long calculation without the use of figures or algebra."* And Dr. Maudsley says, "But neither these instances nor the case of Laura Bridgman can be used to prove that it is possible to think without any means of physical expression. On the contrary the evidence is all the other way. The deaf and dumb man invents his own signs, which he draws from the nature of objects, seizing the most striking outline, or the principal movement of an action, and using

* "The Descent of Man," p. 88. By Charles Darwin, M.A. New York: D. Appleton & Co., 1881.

them afterwards as tokens to represent the objects. The deaf and dumb gesticulate also as they think; and Laura Bridgman's fingers worked, making the initial movements for letters of the finger alphabet, not only during her working thoughts, but in her dreams. If we substitute for 'names' the motor intuitions, or take care to comprise in language all the modes of expressing thoughts, whether verbal, vocal writing, or gesture language, then it is unquestionable that thought is impossible without language."*

As connected thoughts are impossible without words, or signs of words, so words are dependent upon objects for their existence. Says Dr. Maudsley, "Words cannot attain to definiteness save as living outgrowths of realities."† And Heyse says, "Thought is not even present to the thinker till he has set it forth out of himself."

It follows that language has its origin not less in external objects than in the mind. Objects make impressions upon the mind through the senses, and words serve as the means of preserving a record of such impressions and of communicating them to other minds. If, now, the mind should cease to receive impressions, language would no longer be required, since there would be nothing to express; and the occasion for the use of language ceasing to exist, the power of speech would ultimately be lost. The power of speech, then, depends upon a con-

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* "Physiology of the Mind," p. 480. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1883.

† "I therefore declare my conviction," says Max Müller, "whether right or wrong, as explicitly as possible, that thought in one sense of the word, *i. e.*, in reasoning, is impossible without language."—"Physiology of the Mind," p. 480. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1883.

tinuous succession of impressions made upon the mind by its contact, through the senses, with matter in its various forms, whether in nature or in art.

It may also be claimed that the power of speech depends almost entirely upon the endless succession of fresh objects presented to the mind by the hand. These form the subject as well as the occasion of speech. If the hand should cease to make new things, new words would cease to be required. The principal changes in language arise out of new discoveries in science and new inventions in art, each fresh discovery of science giving rise to many new things in art. Art and science react upon each other.* The growth of a State, its advance in the scale of civilization, depends upon progress in the practical arts. Hence the fact that, when a State ceases to advance, its language ceases to grow, becomes stationary, stagnates. In such a State there would be no occasion for new words. If a constantly diminishing number of objects were presented to the mind, speech would become less and less necessary. If no new objects were presented, no fresh impressions upon the mind would be made, and speech would degenerate into a mere iteration. If the hands should cease to labor in the arts, should cease to make things, should cease to plant and gather, the scope of speech would be still further restricted, would be confined to an expression of the wants of savages subsisting on the native fruits of field and forest.

It comes to this, that progress can find expression only

* "And the great advances in science have uniformly corresponded with the invention of some instrument by which the power of the senses has been increased, or the range of action extended."—"Physiology of the Mind," p. 8. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1883.

in the concrete. Guttenberg had an idea that he could employ movable types in the production of books. Suppose he had been content with the mere promulgation of his theory in words, and that those who came after him had been similarly content? There would have been no printing-presses down to the present time. Suppose that Watt and Stephenson and Fulton had been content with the declaration, in words, of the discoveries they made in regard to the application of the power of steam to practical purposes, and that those who came after them had been similarly content? There would have been neither railways, nor steamships, nor steam-driven machinery of any kind down to the present time.

As words are essential to the processes of thought, so objects are essential to words or living speech. And as all objects made by man owe their existence to the hand, it follows that the hand exerts an incalculable influence upon the mind, and so constitutes the most potent agency in the work of civilization. It was not without good reason that Anaxagoras characterized man as the wisest of animals because of his having hands. And what is it to be wise? To be wise is "to have the power of discerning and judging correctly, or of discriminating between what is true and what is false; between what is fit and proper and what is improper." The hand is used as the synonym of wisdom because it is only in the concrete that the false is sure of detection, and it is through the hand alone that ideas are realized in things.* Again we have the hand as the discoverer of truth.

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* "Let him [the youth] once learn to take a straight shaving off a plank, or draw a fine curve without faltering, or lay a brick level in its mortar, and he has learned a multitude of other matters which no

The assertion of the majesty of the hand by the Ionic philosopher of the fourth century B.C. contained the germ of the manual training idea of this latter part of the nineteenth century. Anaxagoras was unconsciously, no doubt, struggling towards the light, towards the inductive method of investigation, towards the sole avenue through which it is possible to study the mind, namely, through the body. The ignorance of the ancients on the subject of physiology was so dense as to leave them no resource save speculative philosophy. The progress made in the study of anatomy, and organic and inorganic chemistry at Alexandria, was, however, considerable. The foundations of a systematic physiology were being securely laid by Hippocrates, Herophilus, and their compeers of the medical profession, and the way was thus being opened to an intelligent study of the mind. It is highly probable that this growing disposition to investigate things, together with the increasing importance to civilization of the useful arts, would soon have reacted destructively upon the speculative philosophy of the time had not a series of national disasters, involving the fall of Greece and Rome, overwhelmed both arts and philosophy in one common ruin.

From the fall of Rome to the time of Bacon speculative philosophy dominated the world. Progress dates from the beginning of the seventeenth century, but it was very slow until within a hundred years. Philosophy has now, however, found a scientific basis. Instead of speculating about the "theory of vitality," it concerns itself with "the natural phenomena of living bodies, so

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lips of man could ever teach him."—"Time and Tide," p. 145. By John Ruskin, LL.D. New York: John Wiley & Sons, 1883.

far as they are appreciable by the human senses and intelligence."

But the schools have not moved forward with events. Their methods are unscientific; they are still dominated by the mediæval ideas of speculative philosophy. One of the ablest educators in this country has well observed that "there has been very little change in the ideas which have controlled our methods of education, and these ideas were formed something like fonr hundred years ago. Like nearly all the great agencies of modern civilization, the established system of education dates from the Renaissance, and the direction given to the schools at that time has been followed with but slight modification ever since."*

The justice of this arraignment of the schools for extreme conservatism is shown by the remark of a prominent educator who opposes the incorporation of manual training in the curriculum of the public schools. He says, "Some even go so far as to regard the fingers as a new avenuc to the brain, and think that great pedagogic advantages will be given by the new method, so that boys may make equal attainments in arithmetic, reading, and grammar in less time. . . . They [teachers] will still find the eye and ear nearer to the brain than the hand." No assumption could be more false than this, that the eye and the ear are more important organs than the hand because they are located, physically, nearer the brain. The attribute of mobility with which the hand is endowed confers upon it not only the potency of the

* Mr. James MacAlister, Superintendent of Schools of the City of Philadelphia, before the American Institute of Instruction at Saratoga, July 13, 1882.

closest possible proximity, but each of the countless positions it may assume, together with its flexibility and adaptability, multiplies its powers in the order of a geometrical ratio.

This disposition to undervalue the hand is an inheritance from the speculative philosophy of the Middle Ages, which was based on contempt of the body and all its members. The effect of this false doctrine has been vicious in the extreme. Contempt for the body has generated a feeling of contempt for manual labor, and repugnance to manual labor has multiplied dishonest practices in the course of the struggle to acquire wealth by any other means than manual labor, and so corrupted society.

That man should feel contempt for the most efficient member of his own body is, indeed, incomprehensible, since contempt for the hand leads logically to contempt for its works, and its works comprise all the visible results of civilization. To enumerate the works of the hand would be to describe the world as it at present exists in contradistinction to the world in a state of nature. Everywhere we behold with admiration and wonder the marvellous triumphs of the hand, from the iron bridge that spans the torrent of Niagara to the steel micrometer that measures the millionth part of an inch. It matters not whether the hand is nearer or farther from the brain than the eye and the ear, it is able to afford powerful aid to them.

Man would explore the planetary system; he lifts his longing eyes to the starry vault, but in vain; it is a sealed book! The hand fashions the telescope, adjusts it, places it at a convenient angle, and the milky way is resolved into millions of stars, "scattered like glittering dust on the black ground of the general heavens," the lunar mountains are measured, and the spots on the sun revealed. Man would study the anatomy and habits of the myriads of insects in which the teeming earth abounds. Impossible! The mechanism of the eye is not adapted to such a delicate operation. But the hand presents the microscope, and a world of hitherto unknown minute existences is revealed with a distinctness which permits the most exhaustive investigation. Thus, through the aid of the hand, the eye now contemplates with philosophic interest the ever-changing aspect of the spots on the sun at a distance of ninety million miles, and now imprisons the red ant, measuring only $\frac{6}{100}$ of an inch in length, and studies its physiology, counting its pulsations, classifying its nerves and muscles, and weighing its brain. Man would speak with his friend or business correspondent miles away. Neither the voice nor the ear is adapted to the task. But the hand fashions and presents the telephone, and the conversation proceeds even in a whisper. It will be said that the mind devises the telescope, the microscope, and the telephone. True, but their construction would be impossible without the hand. And is it at all probable that the mind would have devised these admirable instruments if man had been made without hands?*

* "The hand is the most marvellous instrument in the world; it is the necessary complement of the mind in dealing with matter in all its varied forms. It is the hand that 'rounded Peter's dome;' it is the hand that carved those statues in marble and bronze, that painted those pictures in palace and church, which we travel into distant lands to admire; it is the hand that builds the ships which sail the sea, laden with the commerce of the world; it is the hand that constructs the machinery which moves the busy industries of this age of steam; it is the hand that enables the mind to realize in a thousand ways its highest imaginings, its profoundest reasonings, and its most practical inventions." — Mr. James MacAlister, Superintendent of Schools of the City of Philadelphia, before the American Institute of Instruction at Saratoga, July 13, 1882.

CHAPTER XV.

THE POWER OF THE TRAINED HAND.

The Legend of Adam and the Stick with which he subdued the Animals.—The Stick is the Symbol of Power, and only the Hand can wield it.—The Hand imprisons Steam and Electricity, and keeps them at hard Labor.—The Destitution of England Two Hundred and Fifty Years ago: a Pen Picture.—The Transformation wrought by the Hand: a Pen Picture.—It is due, not to Men who make Laws, but to Men who make Things.—The Scientist and the Inventor are the World's Benefactors.—A Parallel between the Right Honorable William E. Gladstone and Sir Henry Bessemer.—Mr. Gladstone a Man of Ideas, Mr. Bessemer a Man of Deeds.—The Value of the latter's Inventions.—Mr. Gladstone represents the Old Education, Mr. Bessemer the New.

It has been remarked that man is the wisest of animals because he has hands. It is equally true that he is the most powerful of animals because he has hands. It is with the hand that man has subdued all the animals. There is a legend to the effect that on the day when Adam revolted against his Maker, the animals, in their turn, revolted against him, and ceased to obey him. "Adam called on the Lord for help, and the Lord commanded him to take a branch from the nearest tree and make of it a weapon, and strike with it the first animal that should refuse to obey him. Adam seized the branch, the leaves fell from it of their own accord, and he found himself furnished with a stick proportioned to his height. When the animals saw this weapon in the hands of the man they were seized with an instinctive fear mingled with wonder, and they did not dare to attack him. A lion alone, bolder than the rest, leaped upon him to devour him, but Adam, who stood upon his guard, swift as lightning whirled his stick and felled him to the earth with a single blow! At this sight the terror of the other animals was so great that they approached him trembling, and in token of their submission licked the stick that he held in his hand."*

Throughout all the early ages the stick was both the symbol and the instrument of power; and it is only the hand that can grasp and wield the stick. The early kings reigned by virtue of the strong arm and the supple hand. They claimed to be descended from Hercules, and their emblem of power was a knotty stick. Nor does empire depend less upon the hand now than it did in the morning of time.

The hand no longer grasps the knotty stick; it no longer menaces mankind. It wields the mechanical powers. It imprisons steam and electricity, and keeps them at hard labor. It makes ploughs, planters, harvesters, sewing-machines, locomotives, and steamships. It digs canals, opens mines, builds bridges, makes roads, erects mills and factories, constructs harbors and docks, reclaims waste lands, and covers the globe with tracks of steel over which the commerce of the world is borne.

Two hundred and fifty years ago England was destitute of most of these things. It had then no good dirt roads even, no good bridges, no canals, no public works worth mentioning, and scarcely any manufactories of importance. The post-bags were carried on horseback

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* "The Story of the Stick," p. 2. Translated and Adapted from the French of Antony Réal [Fernand Michel]. New York: J. W. Bouton, 1875.

once a week. The highways were besieged by robbers. One-fifth of the community were paupers. Mechanics worked for from sixpence to a shilling a day. The chief food of the poor was rye, barley, or oats. The people were ignorant and brutal—"masters beat their servants, and husbands beat their wives. Teachers used the lash as the principal means of imparting knowledge. The mob rejoiced in fights of all kinds, and shouted with glee when an eye was torn out or a finger chopped off in these savage encounters. Executions were favorite public amusements. The prisons were full, and proved to be fruitful nurseries of crime."

From little better than a wilderness, and almost a state of savagery, England has been transformed into a fruitful field, and its people raised in the scale of civilization. Its public works are the admiration of the world; its coffers are full of gold; its strong boxes are piled high with evidences of the indebtedness of other nations; its ships plough the billows of every sea, and bear the commerce of every land; and its manufactories of vast extent are monuments of inventive genius, industry, perseverance, and skill, more imposing far than the pyramids of Egypt or the temples of Greece and Rome.

To whom do the people of England and of the world owe this national progress, this progress in the useful arts on a scale so colossal as, by comparison, to dwarf the achievements of all the earlier epochs of history? Not to statesmen or legislators. They neither dig canals, open mines, build railways, lay ocean cables, nor erect factories. The pen in their hands may be mightier than the sword; but it is no match for the plough and the reaper, the electric battery and imprisoned steam.

Legislators make laws but mechanics make things. On this subject, after an exhaustive investigation, Buckle says, "Seeing, therefore, that the efforts of government in favor of civilization are, when most successful, altogether negative, and seeing, too, that when these efforts are more than negative they become injurious, it clearly follows that all speculations must be erroneous which ascribe the progress of Europe to the wisdom of its rulers. This is an inference which rests not only on the arguments already adduced, but on facts which might be multiplied from every page of history. . . . We have seen that their laws in favor of industry have injured industry, that their laws in favor of religion have increased hypocrisy, and that their laws to secure truth have encouraged perjury. . . . But it is a mere matter of history that our legislators, even to the last moment, were so terrified by the idea of innovation that they refused every reform until the voice of the people rose high enough to awe them into submission, and forced them to grant what, without much pressure, they would by no means have conceded."*

It is, then, clearly not to the men who make laws that we are indebted for progress in civilization, but to the men who make things. The scientist who discovers a new principle in physics is a public benefactor. The inventor who devises a new machine helps forward the cause of progress. Whitney's cotton-gin trebled the value of the cotton-fields of the South. The mechanic who constructs a machine that will make ten or a hundred things in the time before required to make one

* "History of Civilization in England," Vol. I., pp. 204, 205, 361 By Henry Thomas Buckle. New York: D. Appleton & Co.

thing is in the front rank of the civilizers of the human race.*

Inventors, not statesmen, rule the world through their machines, which augment man's powers and sharpen his senses. Steam has made all civilized countries prosperous and great by vastly increasing man's powers—by making him hundred-handed.†

In 1809 there was born to a distinguished baronet of Liverpool, England, a son. The boy was educated at Eton and Christ Church College, Oxford, graduating in 1831. In 1832 the young man entered Parliament. In 1834 he took office under Sir Robert Peel. The name of the young man who commenced life under such auspicious circumstances is William Ewart Gladstone. For nearly half a century Mr. Gladstone has been a prominent figure in English politics and administration. During this long period of time he has been in the eye of the world, so to speak. He has moulded the laws of an empire, repealed old statutes and made new statutes, largely influenced both the domestic and the foreign policy of a great nation, and exerted a considerable degree of con-

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* "Your wealth, your amusement, your pride, would all be alike impossible, but for those whom you scorn or forget. . . . The sailor wrestling with the sea's rage; the quiet student poring over his book or his vial; the common worker, without praise, and nearly without bread, fulfilling his task as your horses drag your carts, hopeless, and spurned of all: these are the men by whom England lives."—"Sesame and Lilies," p. 68. By John Ruskin, LL.D. New York: John Wiley & Sons, 1884.

† "The causes which most disturbed or accelerated the normal progress of society in antiquity were the appearance of great men; in modern times they have been the appearance of great inventions."—"History of European Morals," Vol. I., p. 126. By William Edward Hartpole Lecky, M.A. New York: D. Appleton & Co.

trol over the international affairs of the continent of Europe.

In 1813, four years after the birth of Mr. Gladstone, at Charlton, in Hertfordshire, England, Henry Bessemer was born. His father, Anthony Bessemer, had fled to England in 1792, a refugee from France. Henry Bessemer's early training consisted of the rudiments of an ordinary education received in the parish school of the neighboring town of Hitchin. His father was a skilled mechanic and inventor, and Henry inherited the inventive faculty. He studied and practised the art of wood-turnery, producing, before arriving at the age of manhood, the most difficult patterns known to the art.

At the age of eighteen, in the year 1831—the year in which Mr. Gladstone completed his education—young Bessemer appeared in London, an obscure, unknown stranger. He, however, secured employment as a modeller and designer. His attention was soon directed to the imperfections of government stamps, in which there had been no improvement since the time of Queen Anne. He was informed by Sir Charles Persley, of the Stamp-office, that the frauds in stamps probably aggregated one hundred thousand pounds per annum. In the evenings of a few months he invented and made an improved stamp which obviated the objections to the one then in use. The invention was at once adopted by the Stamp-office, and in lieu of a stipulated sum in payment therefor, young Bessemer was asked "whether he would be satisfied with the position of superintendent of stamps, with five hundred or six hundred pounds per annum?" The suggested appointment he agreed to accept. Meantime, before the contemplated change occurred in the Stamp-office, the young inventor devised a further improvement in the new stamp, which not only made it much more perfect, but rendered it unnecessary for the government to employ a superintendent of stamps. In perfect good faith young Bessemer exhibited to the chief of the Stamp-office his new stamp, which was so palpably an improvement on the other that it was at once preferred and promptly adopted. What is more, the government not only declined to appoint the inventor to a place, but declined to give him a penny for his invention. This was in 1834, the year in which Mr. Gladstone entered upon his long career as a representative of the British Crown. As young Mr. Gladstone was entering the Treasury, its "junior lord," young Mr. Bessemer was retiring from it an unsuccessful suitor for the just reward of genius and toil. He says, "Thus sad and dispirited, and with a burning sense of injustice overpowering all other feelings, I went my way from the Stamp-office, too proud to ask as a favor that which was indubitably my right."*

From this point, both of time and event, there is a very wide divergence in the lives of these great men. The one is a man of ideas, the other a man of deeds. Mr. Gladstone thinks, talks, makes treaties and laws. He is constantly in the public eye, and his name ever on the public tongue. He is regarded as a great financier; he is certainly a great orator. He sways the multitude with his eloquence. He takes distinguished part in the wordy contests which occur every now and then in Parliament. These debates are much talked of. At the conclusion of one of them there is a vote of want of confidence, and Mr. Gladstone goes out of office and Mr. Dis-

* "The Creators of the Age of Steel," p. 20. By W. T. Jeans. New York: Charles Scribner's Sons, 1884.

raeli comes in. At the conclusion of another of them there is a vote of want of confidence, and Mr. Disraeli goes out of office and Mr. Gladstone comes in. But whether Mr. Gladstone goes out and Mr. Disraeli comes in, or Mr. Disraeli goes out and Mr. Gladstone comes in, makes very little difference with the trade and commerce of the kingdom. The railway traffic continues in the one event or the other; the steamers continue to cross and recross the ocean; the "post" comes and goes; the electric current continues to act as messenger-boy; the telephone brings us face to face with our business correspondent or friend. There is, indeed, no reason why a vote of want of confidence in Mr. Gladstone or Mr. Disraeli should imply a want of confidence in steam or electricity, because neither Mr. Gladstone nor Mr. Disraeli ever have anything to do with the application of these great forces to the uses of man. They are entirely absorbed, the one in promoting the advancement of Liberalism, and the other in promoting the advancement of Toryism. And it is a curious fact, as showing the mutability of political opinion, that Mr. Disraeli entered public life as a Liberal, and subsequently became a great Tory leader; and Mr. Gladstone entered public life as a Tory, and subsequently became a great Liberal leader.

For twenty-two years after he had retired empty-handed from the government Stamp-office Mr. Bessemer continued his career as an inventor and manufacturer, without, however, attracting any great share of public attention. But in 1856 he announced that he had made a discovery of vast importance in the process of steel making.* For a hundred years previously the Huntsman

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* "The first patent of Sir H. Bessemer in which air is mentioned

process had held the field. It yielded excellent steel but was very expensive. Mr. Bessemer announced that he could produce splendid cast-steel at about the cost of making iron. The announcement was received with much incredulity; but the "Bessemer converter" was exhibited, the new process shown, and the result seemed to confirm the verity of the claim of the inventor. Practical difficulties, however, postponed its complete success till 1860, when the new process supplanted all others.

Mr. Bessemer now stood at the head of the inventors of the world, and Mr. Gladstone, as Chancellor of the Exchequer under Lord Palmerston, had come to be regarded as one of the most skilful governmental financiers in Europe, which meant that he was an adept in devising schemes of taxation calculated to yield the most revenue with the least popular discontent. When it is considered that it is necessary for the English Minister of Finance to draw from the British people more than a million dollars every morning of the year, including Sundays, before either the English lord or the English peasant can indulge in a free breakfast, so to speak, the extreme delicacy of the duties devolving upon him will be understood and appreciated. If he proposes the repeal of the soap tax in order to extinguish the slave-trade, he must impose an additional penny in the pound on malt liquors in order to put an end to the vice of drunkenness. He is constantly between Scylla and Charybdis — in keeping

as the oxidizing agent is dated October 17, 1855, and other three months were spent in experimenting before the idea of introducing the air from the bottom of a large converter struck him. The patent embodying the latter idea is dated February 11, 1856."—"The Creators of the Age of Steel," note to p. 38. By W. T. Jeans. New York: Charles Scribner's Sons, 1884.

off the one he is in danger of being swallowed up in the other. And if he can, at the end of the fiscal year, find a million dollars to apply to the liquidation of the public debt, he is extremely fortunate. From 1836, about the time Mr. Gladstone began his public career, down to ten years ago, the several chancellors of the English Exchequer, including Mr. Gladstone, contrived to save, in the aggregate, about thirteen million dollars for this purpose.

Let us recur a moment to the subject of the invention of Mr. Bessemer. It went into operation in 1860. The temptation to reproduce Mr. Bessemer's own description of his process, which revolutionized the manufacture of steel, is irresistible. It is as follows:

"The converting vessel is mounted on an axis at or near its centre of gravity. It is constructed of boiler-plates, and is lined either with fire-brick, road-drift, or gannister, which resists the heat better than any other material yet tried, and has also the advantage of cheapness. The vessel, having been heated, is brought into the requisite position to receive its charge of melted metal, without either of the tuyeres (or air-holes) being below the surface. No action can therefore take place until the vessel is turned up (so that the blast can enter through the tuyeres). The process is thus in an instant brought into full activity, and small though powerful jets of air spring upward through the fluid mass. The air, expanding in volume, divides itself into globules, or bursts violently upward, carrying with it some hundredweight of fluid metal, which again falls into the boiling mass below. Every part of the apparatus trembles under the violent agitation thus produced; a roaring flame rushes from the mouth of the vessel, and as the process advances it changes its violet color to orange, and finally to a voluminous pure white flame. The sparks, which at first were large, like those of ordinary foundery iron, change into small hissing points, and these gradually give way to soft floating specks of bluish light as the state of malleable iron is approached. There is no eruption of cinder as in the early experiments, although it is formed during the process; the improved shape of the converter causes it to be retained, and it not only acts beneficially on the metal, but it helps to confine the heat, which during the process has rapidly risen from the comparatively low temperature of melted pig-iron to one vastly greater than the highest known welding hêats, by which malleable iron only becomes sufficiently soft to be shaped by the blows of the hammer; but here it becomes perfectly fluid, and even rises so much above the melting point as to admit of its being poured from the converter into a founder's ladle, and from thence to be transferred to several successive moulds." *

What is the value of this process? What is the extent of the service rendered by Mr. Bessemer to man? It is estimated that in the twenty-one years first elapsing after the successful working of the Bessemer process, the production of steel by it, notwithstanding its necessarily slow progress, amounted to twenty-five million tons. At $200 a ton, the alleged saving in cost as compared with the old process, this represents an aggregate saving of $5,000,000,000. In 1882 the world's production was four million tons, which at the rate named yields a saving of the enormous aggregate of $800,000,000 in a single year. These sums seem almost fabulous, especially so since they result from simply blowing air through

* "The Creators of the Age of Steel," p. 71. By W. T. Jeans. New York: Charles Scribner's Sons, 1884.

crude melted iron for a quarter of an hour! But the radical character of the change wrought in the metal by the air-blowing process is shown by the fact that a steel rail is worth as much as twenty iron rails.*

All the governments of Europe honored Mr. Bessemer for his great invention, some by medals and orders of merit, and others by appropriating without compensation his process of steel-making. Of these latter Prussia stood in the front rank. England alone stood aloof. "A prophet is not without honor save in his own country and among his own kin." From 1860 to 1872 England continued to load Mr. Gladstone and Mr. Disraeli with honors, but not until the latter year did the government recognize Mr. Bessemer, when the Prince of Wales presented him with the Albert gold medal, and in 1879 he was knighted by the Queen.

A comparison between the lives and services to man of two of the most distinguished statesmen of England, with the life and services, to man, of Sir Henry Bessemer, cannot fail to be of great value to every young man who possesses the power of just discrimination. But can just discrimination be expected of any young man entering

* "At the Birmingham meeting of the British Association in 1865, Sir Henry Bessemer explained that at Chalk Farm steel rails were laid down on one side of the line and iron rails on the other, so that every engine and carriage there had to pass over both steel and iron rails at the same time. When the first face was worn off an iron rail it was turned the other way upward, and when the second face was worn out it was replaced by a new iron rail. When Sir Henry exhibited one of these steel rails at Birmingham only one face of it was nearly worn out, while on the opposite side of the line eleven iron rails had in the same time been worn out on both faces. It thus appeared that one steel rail was capable of doing the work of twenty-three iron ones."—"The Creators of the Age of Steel," p. 93. By W. T. Jeans. New York: Charles Scribner's Sons, 1884.

upon the stage of active life when such discrimination is not possessed by the public at large? For example: The question being propounded, What is the value of the combined services to man of Mr. Gladstone and Mr. Disraeli, as compared with those of Sir Henry Bessemer? ninety-nine out of a hundred men of sound judgment would doubtless say, "The value of the services of the two statesmen is quite unimportant, while the value of the services of Mr. Bessemer is enormous, incalculable." But how many of these ninety-nine men of sound judgment could resist the fascination of the applause accorded to the statesmen? How many of them would have the moral courage to educate their sons for the career of Mr. Bessemer instead of for the career of Mr. Disraeli or of Mr. Gladstone?* Not many in the present state of public sentiment. It will be a great day for man, the day that ushers in the dawn of more sober views of life, the day that inaugurates the era of things in the place of words.

Mr. Gladstone stands for politics and statesmanship at their best, and his career is the product of the old system of education at its best. Mr. Bessemer stands for science and art united, and his career is the product of the new education.

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* "If there were two valleys in California or Australia with two different kinds of gravel in the bottom of them, and in the one stream-bed you could dig up, occasionally and by good-fortune, nuggets of gold, and in the other stream-bed, certainly and without hazard, you could dig up little caskets containing talismans which gave length of days and peace, and alabaster vases of precious balms which were better than the Arabian dervish's ointment, and made not only the eyes to see, but the mind to know whatever it would—I wonder in which of the stream-beds there would be most diggers?"—"Time and Tide," p. 100. By John Ruskin, LL.D. New York: John Wiley & Sons, 1883.

CHAPTER XVI.

THE INVENTORS, CIVIL ENGINEERS, AND MECHANICS OF ENGLAND, AND ENGLISH PROGRESS.

A Trade is better than a Profession.—The Railway, Telegraph, and Steamship are more Potent than the Lawyer, Doctor, and Priest.—Book-makers writing the Lives of the Inventors of last Century.—The Workshop to be the Scene of the Greatest Triumphs of Man.—The Civil Engineers of England the Heroes of English Progress.—The Life of James Brindley, the Canal-maker; his Struggles and Poverty.—The Roll of Honor.—Mr. Gladstone's Significant Admission that English Triumphs in Science and Art were won without Government Aid.—Disregarding the Common-sense of the Savage, Legislators have chosen to learn of Plato, who declared that "The Useful Arts are Degrading."—How Improvements in the Arts have been met by Ignorant Opposition.—The Power wielded by the Mechanic.

The young man with a mechanical trade is better equipped for the battle of life than the young man with a learned profession. The prizes may not be so dazzling, but they are more numerous, and they are within reach. The skilled mechanic, with industry and prudence, is sure of a cottage, and the cottage may grow into a mansion, while the man of letters struggles so often in vain to mount the steps of a palace. The railroad, the telegraph, and the steamship exert a more potent influence upon the destinies of mankind than the lawyer, the doctor, and the priest. The giants, steam and electricity, which bear the great burdens of commerce, have to be harnessed to enable them to do their work; and to make this harness, the furnace, the forge, and the shop are brought into requisition. The railroad alone taxes to the utmost nearly every department of the useful arts. To the construction of the passenger-coach, for instance, more than a hundred trades contribute the varied cunning and skill of their workmanship.

This is the age of steel, and he who knows how to mould the king of metals into puissant forms has his hand nearest the rod of empire. Who would not rather be able to construct a Corliss engine than learn the trick of drawing a bill in chancery?

There was a time, not long ago, when inventors and discoverers were little recognized and poorly compensated for their splendid achievements. But that time is past. The book-makers of to-day are groping about the old shops where the inventors of last century worked, and the cottages where they lived, in order to tell the simple story of their lives, and write their names in the temple of fame. Huntsman, who emerged from long seclusion over the furnace and crucible, and presented to his fellow-workmen a piece of steel which rivalled that of old Damascus, and drove from the British markets all other steels—how resplendent his name is now! How every incident in the life of Watt is sought for—his struggles, his disappointments, and his final success! And so of Mushet, Neilson, Bramah, Maudslay, Clement Murray, Nasmyth, Stephenson, and Fulton. When Watt had devised his engine he found no workmen expert enough to make it. Then Maudslay, Clement, and Murray invented automatic iron hands and fingers, and endowed them with almost human intelligence, and far more than human precision, and Watt's difficulty was removed.

The greasy mechanics did more to hasten the world's progress in a century—1740 to 1840—than had been accomplished up to that time by all the statesmen of all the dead ages. But those heroes of the workshop had none of the opportunities afforded by the manual training school of the present age. They toiled many hours each day for a shilling or two, and lived in stuffy hovels and puzzled over the *a b c* of mechanics by the light of a tallow-candle. Some of them gained fortunes, while others were robbed of the fruits of genius, and slept in unknown graves, but all their names are treasured and honored now. The world moves, and in this age it moves always towards a higher appreciation of the value of the useful arts. This country is destined to become a vast workshop, and in this workshop the best energies, the strongest vital forces of the American people are eventually to be exerted. How necessary, then, to educate the hands as well as the brain of the youth of the country.

Mr. Smiles, in his "Lives of the Engineers," has shown us the true springs of English greatness. In telling the story of the struggles and triumphs of the canal-makers, the bridge-builders, the coal-miners, the millwrights, the road-makers, the harbor and dock makers, the ship-builders, the iron and steel makers, and the railway-builders—in telling this story of persistence, of nerve, and "pluck," he has sketched the career of the real heroes of English progress. A brief sketch of the life of James Brindley will serve to show how these noble men wrought, how they suffered, and how they conquered.

James Brindley was born in 1716. His parents were poor. His father was a ne'er-do-well. His mother taught him to be honest and industrious. James worked as a common laborer till he was seventeen years of age. In 1733 he became a millwright's apprentice — bound for seven years. He was a dull boy, learning slowly, but before the end of his "bound" term he became the best workman in the neighborhood. He helped the now celebrated Wedgwoods out of a difficulty by inventing and constructing flint-mills for their works. He invented and constructed pumps for clearing the Clifton coalmines of water—an entirely new device that opened coal chambers which had long been completely drowned out. His compensation for this class of work—the work of genius—was two shillings a day!

In 1755 he built a silk-mill, in which he made several important improvements in machinery, etc. But this man, who possessed inventive genius of a high order and large executive ability, could neither write legibly nor spell correctly, and his charge for almost inestimable services was still, in 1757, only two to four shillings a day. His struggles to improve the steam-engine form a curious chapter in the story of his life. It was to him that the Duke of Bridgewater owed his success in canal-making.

The duke was born in 1736. He was a weak and sickly child, his mental capacity being apparently defective to a degree sufficient to debar him from his inheritance of the family title and estates. An affair of the heart which resulted unfavorably rendered him morose, and changed his whole course of life. He abruptly quitted the race-track, where he had condescended even to play the rôle of "jockey," and turned his attention to the improvement of his estates. They contained coal deposits, which he undertook to develop through cheapening transportation, and Brindley became his engineer. His first canal, consisting largely of aqueducts, was called "Brindley's castle in the air," and his "river hung in the air." It was this "river hung in the air"—the first

English canal—that made the Manchester of to-day possible. Another canal enterprise of the duke cost more than a million dollars—that connecting Liverpool with Manchester. This latter canal yielded £80,000 per annum income, and it was constructed by Brindley at a salary of 3*s.* 6*d.* a day!

Brindley was obstinate, and often quarrelled with his employer about the methods of construction of great works; and what is more, the duke always submitted. He humbly submitted to every demand made by his engineer except a demand for compensation. Brindley's "wage" rate during the many years occupied in the duke's great canal enterprises was 3*s.* 6*d.* per day. This, at all events, is the price named by Smiles in his life of Brindley. In a note to the work it is, however, stated that his stipulated pay was a guinea a day. It is agreed on all hands, nevertheless, that whatever the rate agreed upon was, Brindley was not paid, and that his heirs were begging unsuccessfully for his just dues long after his death. In a word, Brindley's honor as an engineer being at stake, and it being dearer to him than any money consideration, he worked for nothing rather than allow the enterprise to fail. And the duke was parsimonious enough to take the engineer's services for nothing, and his heirs were mean enough to refuse payment for such services when demanded by his widow.

In a literary point of view Brindley was ignorant, but in no other respect. This was said of him by one of his contemporaries:

"Mr. Brindley is one of those great geniuses whom Nature sometimes rears by her own force, and brings to maturity without the necessity of cultivation. His whole plan is admirable, and so well calculated that he is never at a loss; for if any difficulty arises he removes it with a facility which appears so much like inspiration that you would think Minerva was at his fingers' ends."*

The life of Brindley is typical of a score of biographies presented in the "Lives of the Engineers," among which the following are especially worthy of mention: William Edwards, John Metcalf, John Perry, Sir Hugh Myddelton, Cornelius Vermuyden, Andrew Yarranton,† Andrew Meikle, John Rennie, John Smeaton, Thomas Telford, William Murdock, Dr. D. Papin, Thomas Savery, Dud Dudley, Matthew Boulton, and William Symington. These, and their natural coadjutors, the discoverers of new forces in nature and the inventors of new things in art, the iron-workers and tool-makers—these are *the* great names in English history. They are the names without which there would have been no English history worth writing. Mr. Gladstone once said of them, naming Brindley, Metcalf, Smeaton, Rennie, and Telford, "These men who have now become famous among us had no mechanics' institutes, no libraries, no classes, no examinations to cheer them on their way. In the greatest poverty, difficulties, and discouragements their energies were found sufficient for their work, and they have written their names in a distinguished page of the history of their country."

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* "Lives of the Engineers." By Samuel Smiles. London: John Murray, 1862. Vol. I., "Life of James Brindley."

† "He was the founder of English political economy, the first man in England who saw and said that peace is better than war, that trade is better than plunder, that honest industry is better than martial greatness, and that the best occupation of a government is to secure prosperity at home, and let other nations alone."—"Elements of Political Science." By Patrick Edward Dove. Edinburgh: 1854.

The admission of Mr. Gladstone that the great achievements of these heroes of invention and discovery were won without any aid whatever, either from the government or the people of England, is a pregnant fact. It is the key-note of this work, the reason why it is written and published.

The neglect of the useful arts by all the governments of the world, from the dawn of civilization down to the present time, is an impeachment of the common-sense of mankind as shown in the conduct of public affairs. The civilized man might have learned wisdom from the savage, who is taught to fight, to hunt, and to fish, the brain, the hand, and the eye being trained simultaneously. But he chose to learn of Plato, who in the "Republic" says to Glaucon, "All the useful arts, I believe, we thought degrading." And further in the same work: "We shall tell our people, in mythical language, you are doubtless all brethren as many as inhabit the city, but the God who created you, mixed gold in the composition of such of you as are qualified to rule, which gives them the highest value, while in the auxiliaries he made silver an ingredient, assigning iron and copper to the cultivators of the soil and the other workmen. Therefore, inasmuch as you are all related to one another, although your children will generally resemble their parents, yet sometimes a golden parent will produce a silver child, and a silver parent a golden child, and so on, each producing any. The rulers, therefore, have received this in charge first and above all from the gods, to observe nothing more closely, in their character of vigilant guardians, than the children that are born, to see which of these metals enters into the composition of their souls; and if a child be born in their class with an alloy of copper or iron, they are to have no manner of pity upon it, but giving it the value that belongs to its nature, they are to thrust it away into the class of artisans or agriculturists. And if, again, among these a child be born with an admixture of gold or silver, when they have assayed it they are to raise it either to the class of guardians or to that of auxiliaries, because there is an oracle which declares that the city shall then perish when it is guarded by iron or copper."*

So ingrained in the public mind has this contempt for the artisan and laborer become in the course of ages, that notwithstanding the fact of the admitted kingship of iron among metals, and notwithstanding the fact that without iron the world would almost sink into a state of barbarism, still the opposition to the introduction of tool practice into the public schools is violent, and most violent among those classes who would be most benefited by it. During the pendency of a bill in the Massachusetts Assembly in 1883, providing for the admission of manual training to the public-school curriculum, an opponent of the measure said: "The introduction of the use of tools is only another attempt to deprive the poorer classes of a good education. It is simply an attempt to overload the course of studies in the schools so that children shall not learn anything; so that the poor may be made poorer, while the children of the rich having a good time in the public schools may have their thought and health preserved for higher or special education."

This is a repetition of the old answer of the Inquisition to Galileo upon the announcement and defence of his

* "The Republic of Plato," p. 114. London: Macmillan & Co., 1881.

great discovery. He was summoned to Rome, and "accused of having taught that the earth moves, that the sun is stationary, and of having attempted to reconcile these doctrines with the Scriptures." Bruno had been driven to and fro over the face of the civilized world, and finally burned in the year 1600 for teaching the system of Copernicus. Having the fear of Bruno's fate before his eyes, Galileo recanted, and promised neither to publish nor defend his great discoveries. But his love of science overcame his fear of oppression, and in 1632 he published his "System of the World." Again he was summoned before the Inquisition, which was destined forever after to torment and persecute him. He was driven to his knees before the cardinals, consigned to prison, and tortured to blindness. After his death in prison at the age of seventy-seven years, his right to make a will was disputed, his body was denied burial in consecrated ground, and his friends were prohibited the privilege of raising a monument to his memory in the Church of Santa Croce in Florence.

Eighteen hundred years ago a Roman emperor refused to sanction the use of improved machinery in the prosecution of a great public work, on the ground that it would deprive the poor of employment.

In 1663 a Dutchman erected a saw-mill in England, but the hostility of the workmen compelled its abandonment. More than a hundred years elapsed before the second saw-mill was put in operation in England, and that was destroyed by hand-sawyers.

The Flemish weavers who introduced improved weaving machinery into England in the seventeenth century were met by protests. One of these protests, addressed to Parliament, represented that the Flemish weavers had "made so bould as to devise engines for working of tape, lace, ribbin, and such like, wherein one man doth more among them than seven Englishe men can doe, so as their cheap sale of commodities beggereth all our Englishe artificers of that trade and enricheth them."

A little more than a hundred years ago, in England, when the Sankey Canal, six miles long, was authorized, it was upon the express condition that the boats plying upon it should be drawn by men only.

Illustrations of the *vis inertiæ* of ignorance might be multiplied indefinitely. Ignorance reverences the past. Ignorance never doubts. Ignorance is content; perfectly satisfied with its own knowledge, if the paradox may be allowed, it never seeks to increase it. But it is suspicious. In every effort to enlighten it discovers a conspiracy to undermine. Incapable of the intellectual effort of inquiry, it stagnates, and regards as a deadly enemy those who seek to disturb the serenity of its muddy pool.

When labor was only another name for a state of slavery, to teach men to labor skilfully was merely to raise them to a little higher grade of servitude. Hence it is only at a very recent period that it has occurred to mankind to teach skilled labor in the schools. All educational systems, our own among the rest, seem to have been intended to make lawyers, doctors, priests, statesmen, *littérateurs*, poets. But this is the age of steel, the age of machines and machinery. Tremendous forces in nature have been discovered and utilized, and these discoveries and their utilization have so multiplied vast enterprises that the importance of the more ornamental branches of learning is dwarfed in their presence. This is the practical age, and an educational system which is not practical is nothing. We shall still have our Tennysons, and our Longfellows, and our doctors of abstract philosophy; but there is little time to sentimentalize with the poets or speculate with the philosophers. There is work to do. The mine is to be explored and its treasures brought to the surface; more and more powerful machines are to be constructed to bear the burdens of commerce; new elements of force are to be discovered and applied to the constantly increasing wants of mankind.*

On the subject of the demand for a more comprehensive educational system, Col. Augustus Jacobson says, with great force, "Youth is the expensive period of man's existence. Youth produces nothing and eats all the time. If the youth is not trained there can hardly be a profit to mankind on his existence. As mankind is liable for, and bound to pay, his expenses, he should be so trained that he may repay them. He can only become a profitable investment by training. If he is left unskilled, the money spent on him is wasted. There is no profit on a whole generation of Spaniards or Turks. Mankind should be wise enough to reap the profit there always is in finishing raw material, by making human raw material into a highly finished product."

There are millions of "bright, capable" little human beings in the schools of the United States, receiving,

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* "To know the 'use' either of land or tools you must know what useful things can be grown from the one and made with the other. And therefore to know what is useful, and what useless, and be skilful to provide the one, and wise to scorn the other, is the first need for all industrious men. Wherefore, I propose that schools should be established wherein the use of land and tools shall be taught conclusively—in other words, the sciences of agriculture (with associated river and sea culture), and the noble arts and exercises of humanity.—"Fors Clavigera," p. 302. Part. III. By John Ruskin, LL.D. New York: John Wiley & Sons, 1881.

doubtless, excellent intellectual or mental training. But they are not being trained for the actual duties of life as the savage child is taught to fight, to fish, and to hunt. They are not taught to labor with their hands, either skilfully or unskilfully. They are not given instruction in any department of the useful arts, notwithstanding the fact that in the case of a vast majority of them the alternative of earning their bread by the labor of their unskilled hands, or resorting to their untrained wits for a support, will be presented immediately on their entrance upon the stage of active life. The apprentice system gave skilled mechanics to England, and her splendid manufacturing prosperity is the result. The trained English apprentice became an inventor, and his inventions and art discoveries studded the island with workshops filled with automatic product-multiplying machinery.

The savage of Australia in Captain Cook's time could kill a pigeon with a spear at thirty yards, but he couldn't count the fingers on his right hand. The Southern Esquimau turns a somersault in the water in his boat with ease. But his more Northern brother has no canoe, and is ignorant of the existence of a boat; he has no use for a boat, because the sea in the latitude of his home is frozen the entire year. The savage is taught what he needs to know in his condition, and is taught nothing else; hence his skill in the few avocations he pursues.

The civilized boy in school is taught many theories, but is not required to put any of them in practice; hence he enters upon the serious duties of life unprepared to discharge any of them.* It may be said that he is in

* Discussion of the subject of technical education at a meeting of the Society of Arts, London, England, 1885.

Dr. Gladstone, F.R.S.: "It should be their aim in [elementary real danger of the penitentiary until he learns a profession or a trade. "Of four hundred and eighty-seven convicts consigned to the State Prison for the Eastern District of Pennsylvania in 1879, five-sixths had attended public schools, and the same number were without trades." It is noticeable also that during the same period "not five were received who were what are called mechanics." In the penitentiary of the State of Illinois four out of five of the convicts have no handicraft. The fact that the skilled workman is far more likely than the common laborer to keep out of the penitentiary is a powerful argument in favor of joining manual training to the mental exercises of our common schools.

The general adoption of a comprehensive system of mechanical education in the public schools would quickly dispel the unworthy prejudice against labor which taints the minds of the youth of the country. The splendid career which this age opens to the educated mechanic would become clear to the vision of every boy in the land, and he would see, in the tools he was taught to

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schools] to give such a notion of the value of materials and the use of tools as could afterwards be turned to use in any required direction. There were two great difficulties in the way of doing this. The first and greatest was the inveterate notion that education consisted of book-learning. . . . Another difficulty was the ignorance of teachers in this respect. If an endeavor were made to introduce some knowledge of science into schools, they generally found that the teachers had some kind of theoretical knowledge, but it had been obtained mainly from books; and what was chiefly wanted was that things should be taught as well as words and before words."

Prof. Guthrie, F.R.S.. "This method of bringing the hand and the mind to work together really lay at the basis of all true technical instruction; where the mind alone was employed the knowledge acquired passed away, but when the mind and the hand had been educated together the knowledge was never forgotten."

handle, the key not only to fair success, but to wealth and fame. Professor Thurston, President of the American Society of Mechanical Engineers, thus depicts the tremendous power wielded by the mechanic:

"The class of men from whose ranks the membership of this society is principally drawn direct the labors of nearly three millions of prosperous people in three hundred thousand mills, with $2,500,000,000 capital; they direct the payment of more than $1,000,000,000 in annual wages; the consumption of $3,000,000,000 worth of raw material, and the output of $5,000,000,000 worth of manufactured products. Fifty thousand steam-engines, and more than as many water-wheels, at their command turn the machinery of these hundreds of thousands of workshops that everywhere dot our land, giving the strength of three million horses night or day."*

* Inaugural address, as President of the American Society of Engineers, New York, November 4, 1880.

CHAPTER XVII.

POWER OF STEAM AND CONTEMPT OF ARTISANS.

A few Million People now wield twice as much Industrial Power as all the People on the Globe exerted a Hundred Years ago.—A Revolution wrought, not by the Schools and Colleges, but by the Mechanic.—The Union between Science and Art prevented by the Speculative Philosophy of the Middle Ages.—Statesmen, Lawyers, Littérateurs, Poets, and Artists more highly esteemed than Civil Engineers, Mechanics, and Artisans.—The Refugee Artisan a Power in England, the Refugee Politician worthless.—Prejudice against the Artisan Class shown by Mr. Galton in his Work on "Hereditary Genius."—The Influence of Slavery: it has lasted Thousands of Years, and still Survives.

WHAT the civil engineers and mechanics of England have done for that country the same classes here have done for America. It is by these classes that all civilized countries have been made prosperous and great. And the agent through which the power of man has been augmented a thousand-fold is steam. "In the manufactures of Great Britain alone, the power which steam exerts is estimated to be equal to the manual labor of four hundred millions of men, or more than double the number of males supposed to inhabit the globe."* This is the most significant fact of all time, namely, that a few millions of people in a small island now wield twice as much industrial power as all the people on the globe exerted one hundred years ago. And it is a fact of the utmost

* "Brief Biographies: James Watt," p. 1. By Samuel Smiles. Chicago: Belford, Clark & Co., 1883.

significance that the public educational institutions of England contributed scarcely anything to this industrial revolution, whose influence now comprehends all civilized countries. The men by whom it was wrought came not from the classic shades of the universities, but from the foundery, the forge, and the machine-shop. There has been very little change in educational methods since the time when Bacon said, "They learn nothing at the universities but to believe." He proposed that a college be established and devoted to the discovery of new truth. No such college has, however, been established, but many new truths have been discovered. Suppose all the universities of England, of the United States, and of all other highly civilized countries had, from the time of Bacon, been conformed to his ideas, and devoted to the discovery of new truths? Such a course would have united science and art, and insured vastly greater progress, no doubt, than that which has actually taken place. The union of science with art has thus far been rendered impossible by reason of the wide prevalence of purely speculative views. The speculative philosophy of the Middle Ages still projects its baleful influence over our institutions of learning. Abstract ideas are still regarded as of more vital importance than things. Statesmen, lawyers, littérateurs, poets, and artists are more highly esteemed than civil engineers, machinists, and artisans. Mr. Smiles, in his excellent work on the Huguenots, has shown that England owes to the French and the Flemish immigrants "almost all her industrial arts and very much of the most valuable life-blood of her modern race."* Commenting

* "In short, wherever the refugees settled they acted as so many missionaries of skilled work, exhibiting the best practical examples of diligence, industry, and thrift, and teaching the English people in the

upon this fact in his work on "Hereditary Genius," Mr. Francis Galton says,

"There has been another emigration from France of not unequal magnitude, but followed by very different results, namely, that of the revolution of 1789. It is most instructive to contrast the effects of the two. The Protestant emigrants were able men, and have profoundly influenced for good both our breed and our history; on the other hand, the political refugees had but poor average stamina, and have left scarcely any traces behind them."*

This is the testimony of a distinguished student of biology; and it is to the effect that the refugee artisan is of immense value to the country where he finds an asylum, while the refugee politician is of no value at all. We should naturally say, our author having made this important discovery will make much of it. First of all, he will deduce the conclusion that if the refugee politician is of no value to the country where he finds an asylum, the home politician is an equally unimportant factor in the social problem. Then he will make an exhaustive study of the industrial class as the chief basis of his propositions and speculations on the subject of the science of life. Not at all. Mr. Galton, in his work on "Hereditary Genius," offers another striking illustration of the repressive force of habit and the influence of popular prejudice. In his classifications of men according to

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most effective manner the beginnings of those various industrial arts in which they have since acquired so much distinction and wealth."—"The Huguenots," p. 107. By Samuel Smiles. New York: Harper & Brothers, 1867.

* "Hereditary Genius," p. 360. By Francis Galton, F.R.S., etc. New York: D. Appleton & Co., 1880.

their professions, with a view to the inquiry whether "genius, talent, or whatever we term great mental capacity, follows the law of organic transmission—runs in families, and is an affair of blood and breed"—in such classifications Mr. Galton forgets for the time being that there is an industrial class. He runs through the entire social scale, from "the judges of England between 1660 and 1865," not omitting Lord Jeffreys, down through statesmen, commanders, literary men, poets, musicians, men of science, painters, divines, the boys in Cambridge, oarsmen, and wrestlers of the North Country, but has no word to say of the civil engineers, or of the inventors—those immortal men whose monuments in stone and iron exist in every corner of England.

Buckles's caustic remark, "the most valuable additions made to legislation have been enactments destructive of preceding legislation, and the best laws which have been passed have been those in which some former laws have been repealed," does not apply to the works of the civil engineers, inventors, and mechanics of England or of any other country. Their works live after them and never fail to reflect honor upon them. The "acts" of the inventor may be amended but they are never repealed. Each inventive step, however short and apparently unimportant, constitutes a substantial link in the chain of progress; and it is a substantial link, because it invariably contains a hint of the next sequential step.

Mr. Galton is an original thinker of great power, and an untiring investigator. In contrasting the politician with the artisan he discriminates admirably. He finds that the politician is of no value, practically, to the community, while the artisan is of almost inestimable value;

and this conclusion he states curtly, without appearing to care a rush for the public sentiment which reverences politics and so-called statesmanship. But when he "makes up his jewels," so to speak, on the subject of "hereditary genius," Mr. Galton, as already remarked, forgets that it is worth while to consider the class of men who in the last hundred years have literally almost created a new world. Why is this? The late Mr. Horace Mann answered the question long ago, and he answered it so well that his answer is here reproduced *in extenso:* "Mankind had made great advances in astronomy, in geometry, and other mathematical sciences, in the writing of history, in oratory and in poetry, in painting and in sculpture, and in those kinds of architecture which may be called regal or religious, centuries before the great mechanical discoveries and inventions which now bless the world were brought to light; and the question has often forced itself upon reflecting minds why there was this *preposterousness*, this inversion of what would appear to be the natural order of progress? Why was it, for instance, that men should have learned the courses of the stars and the revolution of the planets before they found out how to make a good wagon-wheel? Why was it that they built the Parthenon and the Coliseum before they knew how to construct a comfortable, healthful dwelling-house? Why did they build the Roman aqueducts before they framed a saw-mill? Or why did they achieve the noblest models in eloquence, in poetry, and in the drama before they invented movable types? I think we have arrived at a point where we can unriddle this enigma. The labor of the world has been performed by ignorant men, by classes doomed to ignorance from sire to son; by the bondmen and the bondwomen of the

Jews, by the helots of Sparta, by the captives who passed under the Roman yoke, and by the villeins and serfs and slaves of more modern times."

When the great educational reformer of Massachusetts thus graphically pointed out slavery as the cause of the contempt in which the useful arts had been held from the dawn of history, four millions of men were kept in bondage and compelled to toil under the lash by one of the most enlightened nations of the earth. Later thirteen millions of people pledged "their lives, their fortunes, and their sacred honor" to the perpetuation of slavery, and half a million soldiers marched repeatedly to battle to do or die in behalf of the right (?) of one man to buy and sell the bodies of his fellow-men.

There is, then, a logical reason for Mr. Galton's neglect of the artisan class. Slavery in its most odious form not only existed in the heart of a so-called "free" nation twenty-five years ago, but dared Liberty to a deadly contest. Nor were the upholders of slavery without moral support among the governments and peoples of the world. The government of England, of which Mr. Galton is a subject, under cover of a pretended neutrality aided the American slaveholders' Confederacy in sweeping Freedom's ships from the sea; and the great families of England, the families cited by Mr. Galton in support of his proposition that genius "is an affair of blood and breed"—those great families were well pleased when Freedom's ships went down and Freedom's armies retreated before the assaults of the slave confederacy.

This somewhat extended reference to Mr. Galton is not intended to impugn his good faith as an author. Its design is simply to show that the influence of slavery is not yet extinct; that it still moulds ideas, controls habits of thought, inspires literary men, and permeates literature. In a word, the cause of the contempt in which the useful arts were held in Babylon in the time of Herodotus was in full force in this country down to the date of the issuance of Mr. Lincoln's proclamation of emancipation; and it is scarcely necessary to observe that the British Constitution grew out of the feudal system, which was only another name for slavery. It is a proverb in England to this day that it is safer to shoot a man than a hare; and the sentiment of the proverb is a complete justification of human bondage, since it implies that property rights are more sacred than the rights of man. Thus slavery has kept its brand of shame upon the useful arts for thousands of years, and the mind of man has been so deeply impressed thereby that it does not react now that slavery is extinct. Like the slave released from bondage, who still feels the chain, still winces and shrinks from the imaginary scourge, the mind of man continues to revolve automatically in the old channels.

CHAPTER XVIII.

AUTOMATIC CONTRASTED WITH SCIENTIFIC EDUCATION.

The Past tyrannizes over the Present by Interposing the Stolid Resistance of Habit.—Habits of Thought like Habits of the Body become Automatic.—There is much Freedom of Speech but very little Freedom of Thought: Habit, Tradition, and Reverence for Antiquity forbid it.—The Schools educate Automatically.—A glaring Defect of the Schools shown by Mr. John S. Clark, of Boston.—The Automatic Character of the Popular System of Education shown by the Quincy (Mass.) Experiment.—Several Intelligent Opinions to the same Effect.—The Public Schools as an Industrial Agency a Failure.—A Conclusive Evidence of the Automatic and Superficial Character of prevailing Methods of Education in the Schools of a large City.—The Views of Colonel Francis W. Parker.—Scientific Education is found in the Kindergarten and the Manual Training School.—"The Cultivation of Familiarity betwixt the Mind and Things."—Colonel Augustus Jacobson on the Effect of the New Education.

All reforms must encounter the stolid resistance of habit. It is not less tyrannical because it is a negative force. It braces itself and holds back with all its might. It is in this manner that the past dominates the present. This automatic habit of mind is precisely like certain automatic habits of the body which operate quite independently of any act of volition. For example: "When we move about in a room with the objects in which we are quite familiar, we direct our steps so as to avoid them, without being conscious what they are or what we are doing; we *see* them, as we easily discover if we try to move about in the same way with our *eyes* shut, but we do not *perceive* them, the mind being fully occupied with some train of thought."* In the same way the mind under certain conditions becomes an automaton, constantly revolving old thoughts after the causes that gave rise to them have ceased to operate. Piano-forte playing affords an excellent illustration of this automatic action of the mind. "A pupil learning to play the piano-forte is obliged to call to mind each note, but the skilful player goes through no such process of conscious remembrance; his ideas, like his movements, are automatic, and both so rapid as to surpass the rapidity of succession of conscious ideas and movements."†

Freedom of speech and freedom of thought are catch-penny phrases. There is much of the former, but very little of the latter. Speech is generally the result of automatic thought rather than of ratiocination. Independent thought is of all mental processes the most difficult and the most rare; habit, tradition, and reverence for antiquity unite to forbid it, and these combined influences are strengthened by the law of heredity. The tendency to automatic action of the mind is still further promoted by the environment of modern life. The crowding of populations into cities, and the division and subdivision of labor in the factory and the shop, and even in the so-called learned professions, have a tendency to increase the dependence of the individual upon the mass of society. And this interdependence of the units of society renders them more and more imitative, and hence more and more automatic both mentally and physically.

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* "Body and Mind," p. 22. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1883.

† Ibid., p. 26.

Another powerful influence contributes to the same end. The schools educate automatically. They train the absorbing powers of the brain, but fail to cultivate the faculties of assimilation and recreation, and neglect almost wholly to develop the power of expression. Mr. John S. Clark, of Boston, has made this point of the failure of the schools to train the brain-power of expression to its utmost so plain that it is here reproduced in full, as follows:

"Studying the functions of the brain, we find that for educational purposes it may be likened to an organism with a threefold form of working, an organism with a power of absorption, a power of assimilation and recreation, and a power of expressing or giving out. The force or character of a brain is measured entirely by its expressing power, by what comes out of it. Examining a little closer, we find that the brain absorbs through all the five senses, while for expressing purposes it makes use of but two of these senses, or rather of but two organs of these senses—the tongue and the hand. *Fig.* 1 is a simple diagram representing a brain with the five senses placed on one side, as means of absorbing power, while on the other side the tongue and the hand are placed as organs of expressing power. The other function of the brain, that of assimilation and recreation, cannot of course be graphically represented. It may, however, be said to be the result of the action of the other two functions. Now, the equipping of a brain, or the healthy education of a brain, consists in giving it expressing

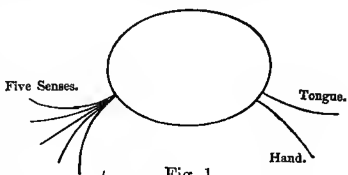

Fig. 1.

power through the tongue and the hand, coextensive with the power of absorption and the power of re-creation.

Applying our popular schemes of education to the brain, and especially those based on the 3-R idea of education, we find what is indicated in *Fig.* 2, that provision has been made for greatly distending the absorbing side of the brain, while for the expressing side, the practical side, provision has been limited to the use of the tongue in speech and to the hand in writing. If now we follow the result of this brain equipment into practical life, we find that speech and writing, as means for expressing

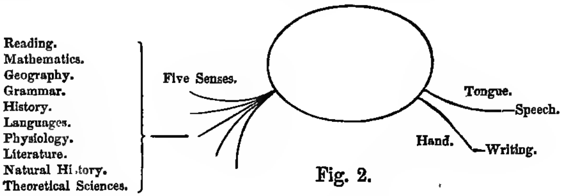

Fig. 2.

thought, have their applications mainly in the commercial and financial employments and the professions, and only incidentally in the industrial and mechanical employments. With such an inadequate and one-sided brain equipment it is not possible in any broad, practical way to bring thought or brain-power to the service of industry. The fact so generally admitted, that we are getting so few intelligent artisans or mechanics from our scheme of public education, that we turn out pupils of both sexes with a decided repugnance to industrial labor, is an attestation to the truth of this statement. The simple fact is that our education is not broad enough on the expressing side of the brain, that too much attention has been given to the absorbing side of this organ, that no adequate provisions have been made whereby it can discharge its power in work connected with the industries.

"In *Fig.* 3 a remedy for this defect is indicated in the addition of the study of graphic and æsthetic art, through drawing, and of training in the manual arts, to the previous brain equipment. Observe where these features come in the scheme—on the expressing side of the brain and in the service of the hand, thus giving the brain ample power to discharge thought in its most complete form for use or for beauty. With these features added to the brain equipment its power of expressing thought

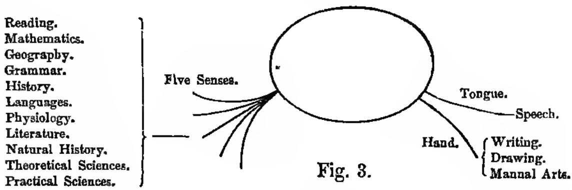

Fig. 3.

in all practical directions will be coextensive with its absorbing and recreating powers; and just as soon as the public can clearly see that in the outcome of our public education there is no respecting of persons or of classes, that pupils are trained for honest labor with their hands as well as to living by their wits, are taught to produce something, to *create values* by the action of their brain through the work of their hands, a much deeper interest in public education will not only be manifested, but generous provisions for its support will also be given."*

The charge that the schools educate automatically

* Address delivered before the Philadelphia Board of Trade and the Franklin Institute, June 6, 1881.

rather than rationally is of such vital importance that it should be sustained by the best attainable proof. Strong proof is at hand in the history of the so-called Quincy (Mass.) experiment.

In 1878 doubt of the efficiency of the schools of Norfolk County, long indulged, culminated in action by the Association of School Committees and Superintendents. It was insisted by certain members of the committee that the existing methods were "about as good as human intelligence could devise," and by others that the people were getting "no adequate returns for the money expended under the system in general use." It was resolved to institute a searching investigation, and the standard for the measurement of the acquirements of pupils adopted was, "a reasonable degree of ability to read, to write legibly, correctly, and grammatically, and to deal readily with simple mathematics after about eight years of schooling."

The association selected Mr. George A. Walton, an experienced educator, to make the examination of the schools of the county, and the number of pupils examined exceeded three thousand. In their preface to Mr. Walton's report the gentlemen of the association say:

"Publicity, discussion, and discontent are wholesome things to apply to school management in Massachusetts. That this is a fair sample of the results now accomplished cannot be questioned. But though they may not be flattering to our pride, we yet believe that they are as good as can be obtained in any other county in Massachusetts, or, indeed, of any other State where similar tests are applied in a similar manner. If any school authorities elsewhere doubt the truth of this statement, let the experiment be tried in the schools of their county.

"The questions naturally arise, What is the cause of this lamentable ignorance? and what is the remedy? The answer to the former suggests the reply to the latter. Too much has been attempted in the schools. There has been a slavish adherence to the text-books, and no room given for freedom and originality of thought. Rules have been memorized, and the children taught to recite from the text-book, while they have not had the slightest conception of the true meaning of the subject. . . .

"The rules and exceptions in grammar are faithfully committed to memory, and most intricate sentences can be successfully analyzed, the phrases separated, and the modifiers named in true grammatical style, while the pupils who have undergone such severe training in this respect are unable to present their own thoughts concisely or clearly, or even *correctly*, upon paper. The *memory* is cultivated, and the *reason* allowed to slumber.

"In arithmetic the pupils show a readiness to solve a problem when they are able to fit it to some rule that they have learned; but when they are given a simple question out of the regular course, they are like a ship at sea without rudder or compass."

This is the severest and most sweeping criticism ever passed upon our American common-school system, and it emanates from its friends and the friends of universal education.

Mr. Walton says of reading, as taught in the Norfolk County schools, "As for any systematic analysis by which the pupil learns to make a careful and independent study of his piece, it is but little practised in the schools even of the grammar grade;" and he declares that reading, without comprehending the ideas of which the words are mere signs, "is not merely useless, but dangerous, just in proportion to the facility with which the words are called."

Of the results of his examinations in penmanship Mr. Walton says, "Most of the faults in the writing indicate imperfect teaching." Of his examinations in spelling he says that "the commonest words are misspelled when used in sentences or composition, while words of difficult orthography are spelled with accuracy when dictated for spelling." For example, he says, "The words 'whose,' 'which,' and 'father,' when spelled orally, were generally correct, but when written in sentences they were frequently in many schools, in a majority of cases, erroneous." No test could more clearly demonstrate the purely mechanical character of the methods of instruction than this of a comparison between the pupils' oral and written spelling. The average of excellence in spelling the three simple words "which, whose, scholar," of the primary grade for the whole county of Norfolk, as found by Mr. Walton, was the exceedingly low one of 55.9, the basis being 100.

The ingenuity in bad spelling of this grade of pupils, who had been at least four years in school, is well illustrated by the example of the word "carriage," written as follows: "Carage, carrage, craidge, caradg, carege, carriag, carrige;" and of the word "sleigh," written "saly, slay, slaig, slaigh, slagh, slaw, sleig, sleugh, sleight, sligh, sley, slew, slave, sleygh;" and of the word "Tuesday," written "Tusgay, tuestay, toesday;" and of the word "Wednesday," written "wanesday, wedenyday, Wederns-day, wednest, Wenday, Wendsday, wensday, wenesday, wensdaw, wenze, Wenzie, Wendsstay, wenstday, Wesday, Whensday, winday, Windday, Winsday," etc.

The word "scholar" presented one hundred and sixty different erroneous spellings; that of "depot" fifty, among which were the following: "Deappow, deppowe, deaphow, deapohoe, teapot, doopo," and "bepo." An exercise in spelling by both grades of pupils, the "primary," composed of pupils from eight and a half to ten and a half years old, and the "grammar," composed of pupils from twelve and a half to fifteen and a half years old, showed errors of which the following are examples: *Any*, spelled ane and enny; *along*, alond and alon; *amongst*, amunt; *animals*, anables; *arithmetic*, rithmes; *asked*, asted; *beautiful*, beuful; *been*, ben, bene, and bin; *by-and-by*, bimeby; *coat*, coot, coth, cote, goat, and coate; *Boston*, bostone; *boy*, poy, and bou; *city*, sitty; *eggs*, ages; *custard-pie*, custed puy; *coming*, comin, commun, gomming, and comming.

An exercise in composition developed the following specimen errors: "The was two boys; They was two boys; How is all the boys? Things that was good; They is not many here I know; He come to school; I see him yesterday; He asked cyrus what he done that day; I had saw him; he had wore a coat," etc.

The examinations in mathematics yielded similar results to those developed in reading, writing, spelling, and composition. Mr. Walton says, "If instead of this [the routine method of the school] the pupil should be compelled to deal with real things, and to find his answer by studying the conditions of his problem, the fiction which arithmetic now is to most pupils would become to them a reality."*

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* "The New Departure in the Common Schools of Quincy," by Charles F. Adams, Jr., and the "Report of Examination of Schools in Norfolk County, Mass.," by George A. Walton. Boston: Estes & Lauriat, 1881.

The prime difficulty is here stated. The schools deal in "fictions." In the language of the Norfolk County committee, "The *memory* is cultivated and the *reason* allowed to slumber." Now, if to every fact memorized the pupil were required to apply the test of reason to analyze it and find out its relation to other facts, and fix it with all its relations in his mind, he would possess certain solid information of an ascertained practical value. It is very simple. It is making the pupil think for himself by showing him how to think for himself instead of thinking for him. Of course this is object-teaching. In the reading-lesson the pupil is required to know the meaning of the words of which it is composed in order to read with correct expression. When required to spell a word orally he is also required to write it. In the study of arithmetic he is shown certain objects, blocks of cubical and other forms, and required to apply the rules of the book to the ascertainment of their contents. In grammar the analysis of the sentence is followed by the writing of it, and the construction of other sentences involving similar principles in the art of composition, and so on.

This is the kindergarten system now rapidly coming into high favor as an essential preliminary step in education. It is also the system of the manual training school. Under that system the pupil is not merely told that the saw is a thin, flat piece of steel with teeth used for cutting boards and timbers; a saw is placed in his hand and he is taught to use it: and so of all the hand and machine tools of the trades. He stands at the forge, bends over the moulding-form, shoves the plane in the carpenter-shop, presides at the turning-lathe, that ingenious invention of Maudslay—an automaton truer than the human eye, more cunning and more accurate than the human hand; executes plans for patterns and then makes the patterns, and finally, from the faint lines he has traced on paper, constructs a machine, breathes the breath of life (steam) into its veins, and with it moves mountains!

In further support of the charge that the schools educate automatically, and hence superficially, the following intelligent opinions are cited:

Charles Francis Adams, Jr., remarks that the common schools of Massachusetts cost $4,000,000 a year; and adds, "The imitative or memorizing faculties only are cultivated, and little or no attention is paid to the thinking or reflective powers. Indeed it may almost be said that a child of any originality or with individual characteristics is looked upon as wholly out of place in a public school. . . . To skate is as difficult as to write; probably more difficult. Yet in spite of hard teaching in the one case and no teaching in the other, the boy can skate beautifully, and he cannot write his native tongue at all."*

Mr. Edward Atkinson says, "We are training no American craftsmen, and unless we devise better methods than the old and now obsolete apprentice system, much of the perfection of our almost automatic mechanism will have been achieved at the cost not only of the manual but also of the mental development of our men. Our almost automatic mills and machine-shops will become mental stupefactories."†

Prof. Barbour, of Yale College, says, "Our schools are

* "Scientific Common-school Education."—*Harper's New Monthly Magazine*, November, 1880, pp. 935, 939.

† "Elementary Instruction in the Mechanic Arts."—*Scribner's Monthly*, April, 1881, p. 902.

suffering from congestion of the brain: too much thought and too little putting it in practice."

An English observer of our public schools says, "They teach apparently for information, almost regardless of development. This system develops no special individuality or power, forms few habits of observation, benefits little except the memory, and herein lies its great weakness."

The late Mr. Wendell Phillips said, "Our system stops too short, and as a justice to boys and girls as well as to society it should see to it that those whose life is to be one of manual labor should be better trained for it."

Mr. Wickersham, late Superintendent of Public Instruction for the State of Pennsylvania, says, "It is high time that something should be done to enable our youth to learn trades and to form industrious habits and a taste for work."

Dr. Runkle, of the Massachusetts Institute of Technology, says, "Public education should touch practical life in a larger number of points; it should better fit all for that sphere in life in which they are destined to find their highest happiness and well-being."

Opinions of this character might be multiplied almost indefinitely. They reflect the general sentiment that, as an industrial agency, the public school is a failure; but its value as an enlightening and civilizing agency is not therefore underestimated. It was not established as an industrial agency; it was established as a bulwark of liberty, and nobly did it fulfil its mission. The colonial fathers had a horror of ignorance, and as a barrier against it they raised the public school. But they were without industrial interests in the higher departments of skilled labor, and without commerce in a large way. Lord Sheffield said that the American colonies were founded with the sole view of securing to England a monopoly of their trade, and Lord Chatham declared that they had no right to manufacture even a nail or a horseshoe. Even after the Revolution, in 1784, the commerce of the country was so insignificant that eight bales of cotton shipped from South Carolina were seized by the customs authorities of England on the ground that so large a quantity could not have been produced in the United States!

These humble conditions no longer exist, and to object to the expansion of the public-school system to meet the requirements of new exigencies is to ignore the logic and march of events. The nations are running an industrial race, and the nation that applies to labor the most thought, the most intelligence, will rise highest in the scale of civilization, will gain most in wealth, will most surely survive the shocks of time, will live longest in history. In the race for industrial supremacy we are not at the front. It is a fact to be pondered that we are exchanging the products of unskilled for skilled labor with the nations of Europe. In the course of a year, for example, England exports of raw material and food only about $150,000,000 in value, while her exports of manufactures aggregate about $850,000,000 in value. On the other hand, our exports consist almost entirely of raw material and food, their annual value being about $800,000,000, while of manufactures we export only a beggarly $75,000,000 worth, and our imports of manufactures are of the annual value of about $250,000,000. In crude, uneducated, unskilled labor capacity we have grown much more rapidly than in the departments of educated, skilled labor; and in the exact ratio of this growth of unskilled over skilled labor we are behind the age. We are industrially ill-balanced. We are selling brawn and buying thought—cunning, invention, genius; exhausting our physical manhood and impoverishing a virgin soil. We are suffering from a paucity of skilled labor, and we hesitate to apply the needed and obviously adequate remedy—the training of the youth of the country in the elements of the useful arts, in the public schools.

A final and conclusive evidence of the verity of the charge that prevailing methods of education are automatic, and hence superficial in their character, is found in an examination test recently made in one of the public schools in a large American city, in the department of mathematics. The superintendent begins to distrust his own system of abstract instruction, and resolves to test the acquirements of certain classes of pupils ranging from ten to twelve years of age. He submits a series of questions in number, which are promptly solved either orally or in chalk on the black-board, showing a complete mastery of the subject from the abstract side, or point of view. To test the practical value of the knowledge thus exhibited the superintendent repeats his series of questions, applying them to things. For example: He passes six cards to a pupil, and requests that one-half of them be returned. This question having been promptly and correctly answered by the return of three of them, and the six cards being again placed in the hands of the pupil, the second question is propounded, namely, "Please give me one-third of one-half of the cards in your hand." The pupil is puzzled; he fumbles the cards nervously, blushes, and returns a wrong number or becomes entirely helpless and "gives it up." This question, or some other question of similar general import, is submitted to each member of the class with a like unfavorable result in eight or nine cases in a total of ten cases. The superintendent is astonished; he is more than astonished, he is deeply chagrined; for he knows that the kindergarten child of six or seven years of age, with the blocks, would answer his series of questions correctly eight or nine times in a total of ten.

It is impossible to conceive of a more striking illustration of the prime defects of automatic education than is afforded by the foregoing described experiment. It sustains and justifies the severe criticism of the schools by Mr. Charles Francis Adams, Jr., in his magazine article of 1880, in the course of which he says,

"From one point of view children are regarded as automatons; from another, as india-rubber bags; from a third, as so much raw material. They must move in step and exactly alike. They must receive the same mental nutriment in equal quantities and at fixed times. Its assimilation is wholly immaterial, but the motions must be gone through with. Finally, as raw material, they are emptied in at the primaries, and marched out at the grammar grades—and it is well!"*

The testimony of Col. Francis W. Parker, of the Cook County (Illinois) Normal School, is to the same effect. He says,

"The most important work of to-day is to collect, reconcile, and apply all the principles and methods of education that have been discovered in the past, into one science and art of teaching. This would certainly radically change all our school work in this country. When

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* "Scientific Common-school Education."—*Harper's New Monthly Magazine*, November, 1880, p. 937.

this is done the ground will be made ready for new advances in the incomplete science of education. Because a complete science has not yet been discovered is a very poor reason for not applying what we already know. What specific changes would the application of known mental laws, in teaching about which all psychologists are in agreement, bring about? For it is only by a sharp comparison of what is now done according to tradition and custom in our schools, with that which can be done by the application of the simplest principles of teaching, that the value of the true art of instruction may be in some degree appreciated.

"To illustrate this it may be mentioned that little children have been taught to read, in the past, and a great majority of them are now taught, by a method that is utterly opposed to a mental law, about which there can be no dispute among those who know anything of the science of teaching. I refer to the A B C method. Nearly three hundred years ago Comenius discovered a rule of teaching which may be said to embrace all rules in its category—'Things that have to be done should be learned by doing them.' This rule is so simple and plain that every one, except the teachers, has adopted and used it since man has lived upon the earth. If I am not very much mistaken, the school-master for the last fifty years has been incessantly inventing ways of doing things in the school-room by doing something else. We try to teach the English language by rules, definitions, analyses, diagrams, and parsing. Before the poor innocent child can write a single sentence correctly, we teach the painful pronunciation of words without the grasping of thought as reading. We vainly endeavor to give children a knowledge of number by teaching figures, the signs of number. We cram our victim's mind full of empty, meaningless words, instead of inspiring and developing it by the sweet and strong realities of thought. This futile struggle to do things by doing something else is to-day costing the people of this country millions and millions of hard-earned dollars; and it is much to be feared that it will one day cost their children the blessings of a free government. This is a serious charge.

"The three hundred thousand teachers of this country are as faithful, honest, and earnest as any other class of active workers. If, then, these great truths in education be at the doors of our educators, why do they not acquire and use them? The answer is not far to seek. Not one teacher in five hundred ever makes a practical, thorough study of the *history* of education, to say nothing of the science.

"The tremendous projecting power of tradition stands stubbornly in the way of progress in education. It can only be met and overcome by the most thorough searching and indefatigable study of the child's nature, and of the means by which the possibilities for good in God's greatest creation may be realized."*

The change from automatic to scientific education ought not to be very difficult. It has been made in the kindergarten. It consists in substituting things in the place of signs. The boy should be taught to read in school as he will be required to read; to write as he will be required to write; and to cipher as he will be required to cipher, when he becomes a man.

In teaching chemistry, for example, there should be

* Letter to the author under date of April, 1883, and by him reproduced in a communication published in the *Chicago Tribune*, April 23, 1883.

a laboratory with the necessary illustrative apparatus. In teaching geography, in addition to the books and the globe, the form of the continent should be moulded in sand, with coast lines, mountain ranges, rivers, canals, harbors, cities, etc. In teaching number the pupil should have the things and parts of things, represented by signs, in his hands. In teaching mechanics the pupil should handle the saw, the plane, the file, the hammer, and the chisel, and stand at the bench, the forge, and the turning-lathe. It is in this way only that the pupil can be taught the power of expressing, as Mr. Clark puts it, "what has been absorbed on the receptive side."

Mr. MacAlister illustrates the force of Mr. Clark's diagrams in a sentence: "We must not close our eyes to the fact that by far the larger number of men in every civilized community are workers to whom a skilled hand is quite as important as a well filled head."* The prevailing methods of teaching fill the head but do not provide for assimilation, recreation, and expression. Now to assimilate, to reduce to practical value and put to use facts memorized, and to create, the power of expression is an essential prerequisite; creating is expressing ideas in concrete form. But under the old *régime* of education only two modes of expression are provided—speech and writing. A third mode—drawing—has been very generally adopted. Drawing, however, is only the first step, an incomplete step, so to speak, of expression. It is a sign, an outline, of a thing. What we want is the thing itself. That thing can only be produced at the forge, the bench, or the lathe; and this is manual training in the arts.

* Mr. James MacAlister, Superintendent of Schools of the City of Philadelphia, Pa., at the meeting of the American Institute of Instruction, Saratoga, N. Y., July 13, 1882.

What manual training will do for the pupil is expressed in the following terse paragraph by Col. Augustus Jacobson:

"The boy leaving school should carry with him mechanical, business, and scientific training, fitting him for whatever it may become necessary for him to do in the world. I would secure for society the advantage of all the brain capacity that is born and all the training it can take. It is possible and practicable to let every child of fair capacity start in life from his school a skilled worker, with the principal tools of all the mechanical employments, an athlete with the maximum of health possible to him, and thoroughly at home in science and literature. The child so trained would, when grown, be to the ordinary man of to-day what Jay-Eye-See is to an ordinary plough-horse."

CHAPTER XIX.

AUTOMATIC CONTRASTED WITH SCIENTIFIC EDUCATION—*Continued.*

The Failure of Education in America shown by Statistics of Railway and Mercantile Disasters.—Shrinkage of Railway Values and Failures of Merchants.—Only Three Per Cent. of those entering Mercantile Life achieve Success.—Business Enterprises conducted by Guess: Cause, Unscientific Education.—Savage Training is better because Objective.—Mr. Foley, late of the Massachusetts Institute of Technology, on the Scientific Character of Manual Education—Prof. Goss, of Purdue University, to the same Effect—also Dr. Belfield, of the Chicago Manual Training School.—Students love the Laboratory Exercises.—Demoralizing Effect of Unscientific Training.—The Failure of Justice and Legislation as contrasted with the Success of Civil Engineering and Architecture.

A STRIKING illustration of the defective character of both public and private systems of education, in the United States, is afforded by the statistics of commercial, railway, and other business failures. In 1877 a careful compilation of figures in regard to the shrinkage of railway values showed the following result:

"In round numbers, *eighteen hundred millions of dollars*, or thirty-eight per cent. of the capital reported as invested in two hundred of our railway companies alone, is wholly unproductive to the investors, and the greater part is wholly lost to them. This is sufficiently appalling, but when we consider how many companies that have managed to keep up the interest on their bonds have wholly, or almost, ceased to pay any interest on their capital stock, which stock, in turn, has shrunk to seventy-five, fifty, twenty-five, ten, in some cases *five* per cent. of its par value, it will seem to be a reasonable conclusion that the actual shrinkage and loss to *somebody* on the face value of railway investments in the United States has been fully fifty per cent.!"*

In view of this startling exhibit it is evident that in the projection, construction, and management of the railways of the United States there has been gross incompetency.

In 1881 Messrs. R. G. Dun & Co., the well-known commercial agents, showed that of the wholesale merchants doing business in the city of Chicago in 1870 fifty per cent. had failed, suspended, or compromised with their creditors.

Forty years ago Gen. Dearborn, a prominent citizen of Chicago, declared that not more than three per cent. of the individuals who embark in trade end life with success. The success meant, doubtless, is unbroken solvency during the business experience of the merchant, and the final accumulation of a competence. The mercantile ranks in the United States afford many instances of individual merchants and firms who have settled or compromised with their creditors several times, and finally succeeded—succeeded at the expense of their creditors. But this is not the success meant by Gen. Dearborn. This statistical information, furnished by Messrs. R. G. Dun & Co., tends to confirm, approximately, the verity of the common remark that in trade not one in a hundred succeeds.

Let us suppose that three merchants in a hundred so conduct their business as never to ask their creditors for

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* *The Chicago Railway Age.*

a favor, never to "settle" for 50 or 25 cents, but always pay "dollar for dollar," and come out in the end rich. This is strictly legitimate success. It would be very interesting to learn what becomes of the other ninety-seven merchants. Most of them go down after a few years, never again to emerge above the surface of commercial affairs. They live on salaries, enter the ranks of the speculative class, or become genteel paupers. But doubtless seven at least of the ninety-seven "compromise" and "settle" themselves over the breakers, and finally achieve success. So that of the ten successful merchants out of a hundred those who succeed at the expense of their creditors are as seven to three of those who win success by the highest degree of mercantile merit.

With ninety utter failures, seven successes which involve the misfortune or wreck of others, and only three untarnished successes in a hundred, the general ambition to enter mercantile life is simply unaccountable. Of course the small number of successful merchants have to calculate upon the failures which will inevitably occur. They must discount the losses they are sure to incur through those failures—provide for them by increasing the otherwise sufficient profit of each transaction. In this way the public pays the cost of each failure. In other words, the consumer is taxed to pay the expense of ninety complete failures, and seven partial failures, in every hundred mercantile experiments. This expense aggregates scores of millions of dollars in this country alone, every year. The sum of losses by the failure of merchants in good seasons is very large, and in seasons of commercial depression it is vast.

It is evident that ninety-seven in every hundred merchants mistake their avocation. Only three in a hundred are exactly fitted for the business they undertake. They are morally the "fittest" who survive by virtue of ability and integrity; the seven who survive by levying contributions on their creditors may also be regarded as the "fittest" according to the Darwinian theory. Of the ninety who go down without even a struggle to "settle" or "compromise," they answer to the received definition of dirt—"matter out of place."

The investigation made by Messrs. R. G. Dun & Co., which resulted in the statistical information here reproduced and commented upon, was brought about by the assertion in 1881 of a life-insurance agent that fifty per cent. of the wholesale merchants doing business in the city of Chicago in 1870 had meantime failed, suspended, or compromised with their creditors. Out of this investigation the question logically springs, "Is not failing in business made too easy?"* If "compromises," "settlements," and "failures" carry with them no disgrace, it is but natural that thousands should take the risk of them in the contest for the great prizes which are the reward of success. The distinction in the public mind between the three merchants in a hundred who succeed legitimately and the seven who succeed by questionable "compromises" or "settlements" is very slight; and too many of the

* "Mercantile honor is held so high in some countries that the calamity of bankruptcy drives men mad. In France there are numerous instances of almost superhuman struggles on the part of ruined merchants to regain, by patient effort and pinching economy, their lost station in the business community. César Birotteau, Balzac's hero of such a struggle, dies from excess of emotion in the hour of his triumph. 'Behold the death of the just!' the Abbé Loraux exclaims, as he regards, with lofty pride, the expiring merchant."—"Ten-minute Sketches," p. 220. By Charles H. Ham. Chicago and New York: Belford, Clark & Co., 1884.

ninety who fail utterly retire with large sums of money which belong honestly to their creditors. Doubtless the life-insurance agent, in depicting the perils of mercantile ventures, urged the propriety of the merchant fortifying himself against disaster by insuring his life for the benefit of his family. This is a legitimate argument when addressed to the merchant in solvent condition; but the life-insurance agent's intimate acquaintance with the shaky finances of nine-tenths of the commercial community teaches him that a large share of the money he receives in premiums, comes not from the merchant, but from the merchant's creditors, who will soon be called upon, in the natural course of events, to consent to a composition of his claim, while the shaky merchant will retire with a paid-up policy of insurance in favor of his family.

It is quite plain that in nine cases out of ten the merchant who carries a large policy of insurance on his life actually pays for it out of his creditors' instead of his own money. To be sure, it may be said that the nine merchants hope and expect to succeed as well as the one. But is not it the duty of the merchant who owes large sums of money to think more of providing means for the payment of his immediate debts than of laying up a support for himself and family in the event of failure? Some disgrace ought to attach to failure in business; that is to say, disgrace enough to make the merchant cautious and economical, with a view, not to his own protection in the event of failure, but to the protection of his creditors, and of his own reputation as a business man.

These failures, on so vast a scale, of railway enterprises, and the almost total wreck of mercantile ventures, show that the business of this country is done, as a Yankee might say, "by guess," or as the mechanic of the old *régime* would say, "by the rule of thumb." The conclusion is hence irresistible that the youth of the United States are not so educated as to fit them for the conduct, to a successful issue, of great business enterprises. And this is an impeachment of what is regarded, on the whole, as the best system of popular education in operation in the world. A system of education which turns out ninety-three or ninety-seven men who fail, to three or seven men who succeed in business, must be very unscientific. If the savage system of education were not better adapted to the savage state, the savage would perish from the earth in the process of civilization. The savage bends his ear to the ground and robs the forest of its secrets, not three times in a hundred, but ninety and nine times. Ninety-nine times in a hundred the savage traces the footsteps of his enemy in the tangled mazes of the pathless wood.

In "Aborigines of Australia"* Mr. G. S. Lang states that "one day while travelling in Australia he pointed to a footstep and asked whose it was. The guide glanced at it without stopping his horse, and at once answered, 'Whitefellow call him Tiger.' This turned out to be correct; which was the more remarkable as the two men belonged to different tribes, and had not met for two years." Among the Arabs it is asserted that some men know every individual in the tribe by his footstep. Besides this, every Arab knows the printed footsteps of his own camels, and of those belonging to his immediate neighbors. He knows by the depth or slightness of the impression whether a camel was pasturing, and therefore

* "Aborigines of Australia," p. 24.

not carrying any load, or mounted by one person only, or heavily loaded. The Australian will kill a pigeon with a spear at a distance of thirty paces. The Esquimau in his kayak will actually turn somersaults in the water. After giving many illustrations of the skill of various races of savages, Sir John Lubbock says,

"What an amount of practice must be required to obtain such skill as this! How true, also, must the weapons be! Indeed it is very evident that each distinct type of flint implement must have been designed for some distinct purpose." He adds, "The neatness with which the Hottentots, Esquimaux, North American Indians, etc., are able to sew is very remarkable, although awls and sinews would in our hands be but poor substitutes for needles and thread. As already mentioned (in page 332), some cautious archæologists hesitated to refer the reindeer caves of the Dordogne to the Stone Age, on account of the bone needles and the works of art which are found in them. The eyes of the needles especially, they thought, could only be made with metallic implements. Prof. Lartet ingeniously removed these doubts by making a similar needle for himself with the help of flint; but he might have referred to the fact stated by Cook in his first voyage, that the New Zealanders succeeded in drilling a hole through a piece of glass which he had given them, using for this purpose, as he supposed, a piece of jasper."*

The education which enables the savage to make these extremely nice adjustments of means to ends is scientific. The observation, for example, of the Arab who draws

* "Prehistoric Times," pp. 544, 548. By Sir John Lubbock, Bart., M.P. New York: D. Appleton & Co., 1875.

such accurate conclusions from the "printed footstep of the camel," if applied to the problems of civilized life, would result in success, not failure.

The excellence of this savage training consists in its practical character, in its perfect adaptation to the end in view. For example, the Esquimau boy is not instructed in the theory of turning somersaults in the water, in his kayak. He sees his father perform the feat; he is given a kayak and required to perform it also. The result is early and complete success. So of the Arab. In traversing the desert it is important for him to read every sign, to translate every mark left in the sand. Upon the accuracy of his observation his life may often depend. The print of the camel's footstep may tell him whether he is, soon or late, to meet friend or foe. Hence from early childhood his faculty of observation is trained until it soon becomes as delicate and nice as the sense of touch of a blind, deaf mute. Sir John Lubbock thinks that a great amount of practice must be required to achieve so much skill; but the results are due probably more to the nature, than to the extent, of the practice. It is the excellence of the training that produces results which excite wonder and admiration. The savage is indolent; he works only that he may eat, and he works well simply because he has been taught objectively instead of subjectively.

The difference in results between the best and the poorest methods of instruction is very great, as witness the testimony of Mr. Thomas Foley, late instructor in forging, vise-work, and machine-tool work in the school of mechanic arts of the Massachusetts Institute of Technology. He says,

"It is a great waste of time to spend two or three years in acquiring knowledge of a given business profession or trade that can be acquired in the short space of twelve or thirteen days under a proper course of instruction. Twelve days of systematic school-shop instruction produces as great a degree of dexterity as two or more years' apprenticeship under the adverse conditions which prevail in the trade-shop."* The manual training methods are the same as those which enable the savage to perform such feats of skill. They are the natural and hence most efficient methods of imparting instruction.

The manual training school is a kindergarten for boys fourteen years of age. Miss S. E. Blow, in formulating the theory of the kindergarten, describes the methods of the savage's school, and those of the manual training school, as follows:

"It is a truth now universally recognized by educators that ideas are formed in the mind of a child by abstraction and generalization from the facts revealed to him through the senses; that only what he himself has perceived of the visible and tangible properties of things can serve as the basis of thought; and that upon the vividness and completeness of the impressions made upon him by external objects, will depend the clearness of his inferences and the correctness of his judgments. It is equally true, and as generally recognized, that in young children the perceptive faculties are relatively stronger than at any later period, and that while the understanding and reason still sleep, the sensitive mind is receiving those sharp impressions of external things which, held fast by memory, transformed by the imagination, and

* Report on "The Manual Element in Education," p. 30. By John D. Runkle, Ph.D., LL.D., Walker Professor of Mathematics, Institute of Technology, Boston, Mass.

finally classified and organized through reflection, result in the determination of thought and the formation of character.

"These two parallel truths indicate clearly that the first duty of the educator is to aid the perceptive faculties in their work by supplying the external objects best calculated to serve as the basis of normal conceptions, by exhibiting these objects from many different stand-points —that variety of interest may sharpen and intensify the impressions they make upon the mind, and by presenting them in such a sequence that the transition from one object to another may be made as easy as possible."*

This admirable exposition of the theory of scientific education solves the mystery which has always enveloped savage skill. It also affords a philosophic explanation of the fact discovered by Mr. Foley, namely, that the student of the manual training school acquires as much knowledge in one hundred and twenty hours as the apprentice of the machine-shop does in two years. In a word, it shows exactly why scientific education is so incomparably superior to automatic education. Mr. Foley asserts, in substance, that the scientific methods of the manual training school are twenty times as valuable to the student as the unscientific methods of the trade-shop are to the apprentice.

In a familiar letter to the author, Prof. Goss† shows why the methods of the manual training school are so very valuable. He says:

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* "The Kindergarten. An address, delivered April 3, 1875, before the Normal Teachers' Association, at St. Louis, Mo."

† Prof. William F. M. Goss, a graduate of the school of mechanic arts of the Massachusetts Institute of Technology, and at present instructor in the mechanic arts department of the Purdue University.

"In such a school, or course, a student is taught to perform a series of operations, involving practice with a variety of tools, on pieces of suitable material. It is not to be supposed that his ability to make a certain piece is directly valuable, for the experience of a lifetime may never require him to make it again. It is not expected that while making the piece he will learn a number of formulated facts relating to his work, and its application to other work, for that is not the best way to learn. Nor can we expect him to acquire a high degree of hand skill (accuracy and rapidity of movement combined), for this his limited time will not permit. But he does this: he works out a practical mechanical problem with every piece he makes. He sees how the tool must be handled, and how the material operated on behaves. He comes to understand why the tool cuts well in some directions and not so well in others; and all the time he queries to himself where it was that he saw a joint like the one he is making. He is an investigator—as much so as a student in chemistry. His mind must always guide his hand; his reasoning opens new fields of thought with every stroke of the chisel.

"A boy ten years old, who was a member of a class under my direction in Indianapolis in 1883, is reported to have said, 'Why, mother, I never looked at the doors and windows so much in all my life as I have since I began at the wood-working school.'

"I tell my students how to go to work when they are likely to make mistakes, and how mistakes may be avoided. In operating along the line directed they thoroughly understand what they are doing, and why they do it. They see on all sides of their work.

"If I have several different tools for doing work of the same character, I frequently give a student first one and then another, until he has tried them all. Then I ask him which he likes best, and why. Suppose we are to make a drawing-board. The class having already been made familiar with the principles governing the shrinkage and warping of woods, is asked in what way the cleats, to prevent warping, may best be fastened to the ends. The question is left open for a day or two, and sketches are submitted and views exchanged on the subject.

"I frequently ask my students to pass to me, in writing, as many facts (not in the form of a composition) as they can think of regarding certain stated features of their work — not facts to be obtained from books, but from things they have seen and with which they are familiar. The replies are often remarkable for accuracy and force of statement. . . .

"The manual training school that does not by its work inspire thought and encourage investigation is poor indeed; the school that assumes its work to be *mind training by hand practice* is the ideal school, and the school that will succeed. . . .

"My answer to your second and third questions is already evident. I consider an hour in the shop as valuable for its intellectual training as an hour of book-study, and two hours in the shop as valuable as two hours of study. I do not think that a student can take two hours of shop-work in addition to a full course of outside study; but I am convinced that two hours in the shop can be made to take the place of one hour of study without extra burden to the student. Therefore, this being done, the student will get as much again intellectual benefit from the shop as he would get if the shop-work equivalent in time were given to book-study."

This description of the mental operations which accompany the shop exercises of the manual training school shows the intimacy of the relations existing between the brain and the hand. It shows how they act and react upon each other, and affords an explanation of the remark of Dr. Belfield,* that the laboratory exercises are in fact a great strain upon the mental constitution of the student. This observation of Dr. Belfield, one of the most distinguished teachers of the old *régime* in the United States, entirely justifies the claim made in behalf of the scientific character of manual training as an educational agency, for it shows that such training is in no sense automatic. If manual training is a great strain upon the mental faculties, it must be because the use of tools stimulates such faculties to great activity. And if this is true, the mental discipline derived from manual training must be proportionally great. This is a pivotal point; for if the observation of Dr. Belfield is well founded in fact and reason, it proves to a demonstration the high educational value of manual training—proves its superiority over all the methods of the old *régime.*

Prof. Goss says, "The manual training school student is an investigator—as much so as a student in chemistry. His mind must always guide his hand, his reasoning opens new fields of thought with every stroke of the chisel. He sees on all sides of his work."† And Dr.

* Henry H. Belfield, A.M., Ph.D., Director of the Chicago Manual Training School.

† "No extent of acquaintance with the meanings of words can give the power of forming correct inferences respecting causes and effects. The constant habit of drawing conclusions from data, and then of verifying those conclusions by observation and experiment, can alone give the power of judging correctly."—"Education," p. 88. By Herbert Spencer. New York: D. Appleton & Co., 1883.

Belfield says that these varied operations of the mind cause a severe mental strain. It would be difficult to find a better exemplification of scientific education than a course of training which exercises simultaneously the powers of both body and mind, a course which with every fresh burden put upon the mind puts new vitality into the body. This is, indeed, the very opposite of automatic education, and we may well call it scientific education.

Another leaf from the experience of Dr. Belfield is worthy of reproduction here. On the 20th of February, 1884, he took the sense of the students in his school on the question whether or not they should indulge in a vacation on Washington's birthday anniversary. Somewhat to his surprise the vote was almost unanimous in the affirmative. He acceded to the wishes of the students, but no sooner was the announcement made, than he was besieged with applications from nearly all of them for permission to convert the holiday into a work-day in the laboratories! Dr. Belfield has been compelled to post a peremptory order against the occupancy of the school laboratories by the students on Saturdays, which are regular vacation days.

Natural training is scientific training. The fondness of the student for the manual training school is evidence of its scientific character. He is fond of it because it is natural. Miss Blow says of the child: "Only what he himself has perceived of the visible and tangible properties of things can serve as the basis of thought, and upon the vividness and completeness of the impressions made upon him by external objects will depend the clearness of his inferences and the correctness of his judgments." This is the education both of the kindergarten and the manual training school, and it brightens, stimulates, and develops, while automatic education stupefies.

Mr. Foley, formerly of the Massachusetts Institute of Technology, declares, as the result of his experience, as already stated, that the scientific methods of the manual training school are twenty times as valuable to the student as the unscientific methods of the trade-shop are to the apprentice. But we have shown in a former chapter that the training of the trade-shops of England, during the past one hundred and fifty years, has been better than that of the English schools and universities; in a word, that England is more indebted for her greatness to her apprentice system than to her school system. It follows that the school system of England must have been almost indescribably poor.

That the system of popular education in the United States, which is much more comprehensive, and presumably better, than that of England, is very poor indeed in results, is shown by the statistics of railway and mercantile disasters; and it is scarcely necessary to remark that these disasters show prevailing methods of education to be as defective morally as they are mentally. The reason of this is that, being automatic, they lead neither to the discovery of truth nor to the detection of error. It is easy to juggle with words, to argue in a circle, to make the worse appear the better reason, and to reach false conclusions which wear a plausible aspect. But it is not so with things. If the cylinder is not tight the steam-engine is a lifeless mass of iron of no value whatever. A flaw in the wheel of the locomotive wrecks the train. Through a defective flue in the chimney the house is set on fire. A lie in the concrete is always hideous; like murder, it will out. Hence it is that the mind is liable to fall into grave errors until it is fortified by the wise counsel of the practical hand.

It is obvious that the reason of the demand for the manual element in education is not so much that industrial interests require to be promoted, as that mental operations may be rendered more true, and hence more scientific. What we need more than we need a better class of mechanics is a better class of men—men of a higher grade both morally and intellectually. The study of things so steadies and balances the mind that the attention being once turned in that direction great results soon follow, as witness, the history of discovery and invention in England.

The world moves very fast industrially, but very slow morally and intellectually. Mechanics stand the test of scrutiny far better than merchants. Civil engineers and architects are more competent than railway presidents, lawyers, judges, and legislators. The reason of this fact is that mechanics, civil engineers, and architects are educated practically in the world's shops and the world's technical schools. They are trained in things, while merchants, railway presidents, lawyers, judges, and legislators have only the automatic word-training of the schools. It is notorious that criminals are not punished in this country. Suppose there were such a failure of bridges as there is of justice. That is to say, suppose eight-tenths of the bridges constructed, whether for railway or other purposes, should fall within a few months of their completion. What would be thought of the technical schools whence the civil engineers graduate?

Ninety-seven merchants in a hundred fail. Suppose ninety-seven buildings in a hundred, constructed under the direction of architects, should tumble down over the heads of their occupants six months after their erection. The education of the architects would no doubt be regarded as defective.

Buckle says of English legislation, "The best laws which have been passed have been those by which some former laws were repealed."* It will be admitted that the same is true of American legislation.† In other words, the average legislator is wiser in the statutes he

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* "History of Civilization in England," p. 200. By Henry Thomas Buckle. New York: D. Appleton & Co., 1864.

"In a paper read to the Statistical Society in May, 1873, Mr. Janson, Vice-president of the Law Society, stated that from the statute of Merton (20 Henry III.) to the end of 1872 there had been passed 18,110 public acts, of which he estimated that four-fifths had been wholly or partially repealed. He also stated that the number of public acts repealed wholly or in part, or amended, during the three years 1870–71–72 had been 3532, of which 2759 had been totally repealed. To see whether this rate of repeal has contiuued I have referred to the annually issued volumes of the 'Public General Statutes' for the last three sessions. Saying nothing of the numerous amended acts, the result is that in the last three sessions there have been totally repealed, separately or in groups, 650 acts *belonging to the present reign*, besides many of preceding reigns. . . .

"Seeing, then, that bad legislation means injury to men's lives, judge what must be the total amount of mental distress, physical pain, and raised mortality which these thousands of repealed Acts of Parliament represent."—"The Man *versus* the State," pp. 50, 51. By Herbert Spencer. New York: D. Appleton & Co.

† "So thoroughly have the conscience and intelligence of the North apprehended these facts [neglect to educate and enlighten the freedmen], that while the Nation has done nothing they have given in private charity, intended to remedy this evil, nearly a million dollars a year for nearly twenty years. This is the instinct of a people *versus* the stupidity of their legislators. . . . Of the true character of the South he [the author] was, like all his class, profoundly ignorant, almost as ignorant as the men who made the Nation's laws."—"An Appeal to Cæsar," pp. 52, 56. By A. W. Tourgée.

repeals than in the bills he enacts. What if the incompetency of the legislator were paralleled by that of the machinist? Suppose ninety-seven in every one hundred locomotives should break down on the "trial-trip," and be returned to the builder's shop for remanufacture. Such a result would be an impeachment of the education of the locomotive builder.

Ninety-seven in every hundred boys who graduate from the public schools and embark in mercantile pursuits fail. Suppose ninety-seven in every hundred watches made in the American watch factories should prove to be worthless. The watch companies would, no doubt, soon be in the hands of the sheriff. But, as a matter of fact, the Elgin National Watch Company, for example, makes twelve hundred watches a day, and each and every one of them is an almost perfect timekeeper.

There is, then, no such failure of the arts as there is of justice; no such failure of mechanics as of merchants; no such failure of locomotives and watches as of legislation. It follows that the education of artisans is better, more scientific, than that of merchants, judges, lawyers, and legislators. And this is a very significant fact when it is considered that the State does much for education in *belles-lettres* and scarcely anything for education in the arts and sciences.*

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* The reason why statutes fail more frequently than steam-engines and bridges is not wholly because the legislator has to deal with human nature and the mechanic with inanimate matter. Steam and electricity are subtle forces, but man has quickly mastered them and successfully applied them to a variety of uses.

It is not to the interest of any one that the machinist should make a defective locomotive, for example; but it is often to the interest of some one that the legislator should enact vicious laws. Vicious statutes are enacted with a design to injure the public in order that certain individuals may be benefited thereby.

If the mind should act as honestly in legislation as the hand does in construction, statutes would not have to be repealed yearly.

We have fallen into the habit of regarding education as a polite accomplishment having very little to do with the real business of life; but this is not the fact. Education begins in the cradle and continues through life; and it makes the man what he is. If he goes to the penitentiary it is his education that sends him there. If he is sent to the General Assembly of the State or to the Congress of the Nation, and there helps to enact vicious laws, it is his education that is responsible for such laws. If the man as a citizen sells his franchise at the polls, or his vote in the legislative hall, for money, it is the education he has received that is responsible for his baseness.

CHAPTER XX.

AUTOMATIC CONTRASTED WITH SCIENTIFIC EDUCATION—*Continued.*

The Training of the Merchant, the Lawyer, the Judge, and the Legislator contrasted with that of the Artisan.—The Training of the Merchant makes him Selfish, and Selfishness breeds Dishonesty.—Professional Men become Speculative Philosophers, and test their Speculations by Consciousness.—The Artisan forgets Self in the Study of Things.—The Search after Truth.—the Story of Palissy.—The Hero is the Normal Man; those who Marvel at his Acts are abnormally Developed.—Savonarola and John Brown.—The New England System of Education contrasted with that of the South.—American Statesmanship—its Failure in an Educational Point of View.—Why the State Provides for Education; to protect Property.—The British Government and the Land Question.—The Thoroughness of the Training given by Schools of Mechanic Art and Institutes of Technology as shown in Things.—Story of the Emperor of Germany and the Needle-maker.—The Iron Bridge lasts a Century, the Act of the Legislator wears out in a Year.—The Cause of the Failures of Justice and Legislation.—The best Law is the Act that Repeals a Law; but the Act of the Inventor is never Repealed.—Things the Source and Issue of Ideas; hence the Necessity of Training in the Arts.

There is a cause for the failure of the merchant, the lawyer, the judge, and the legislator, as well as for the success of the artisan. And the cause must be sought in the courses of training, respectively, of the two classes. Let us assume that the artisan and the merchant, the lawyer, the judge, and the legislator, graduate at the same time from the public high school or from Harvard or Yale. The merchant at once begins to trade, to buy and sell. He concerns himself with things only as they have a value, either naturally arising from the law of demand and supply, or arbitrarily imposed by circumstances. His consideration of the relations of things is confined to the single question of the percentage of profit which may accrue to him from traffic in them. These are subjective processes of thought, and the merchant becomes absorbed in them to the exclusion of all other subjects. It goes without saying that he becomes intensely selfish. The struggle is one of mercantile life or death—ninety-three to ninety-seven in a hundred die, three to seven survive.

Among merchants there is, hence, very little thought of the subject of justice, and no effort to discover truth. There must, at the end of the year, be a favorable balance on the right side of the ledger, or the balance on the wrong side unerringly points the way to ruin. This is the post-school training of the merchant. That neither it nor his previous education renders him skilful we know, since he fails ninety-three to ninety-seven times in a hundred trials. That subjective training does not and never can promote rectitude has been shown in a former chapter of this work. That merchants who compromise with their creditors, and subsequently accumulate fortunes, very rarely repay the debt formerly forgiven is a notorious fact. A Chicago merchant who himself repaid such a composition debt early in his career, states, at the end of twenty-five years' experience, that of compromises involving several hundred thousand dollars, made by him in favor of debtors, not one dollar has ever been repaid.

Upon leaving school or college the lawyer, the judge, and the legislator at once apply themselves to books; their subsequent training is exclusively subjective. Their ideas receive color from and are verified only by reference to consciousness. Subjective truths have no relations to things, and hence are susceptible of verification only through consciousness. They are, therefore, mere speculations after all, often ingenious but always problematical. The result of such training is selfishness—selfishness of a very intense character; and, as has been already shown, selfishness is merely another name for injustice.

On the other hand the artisan devotes himself to things. His training is exclusively objective. His ideas flow outward; he studies the nature and relations of things. In this investigation he forgets self because his life becomes a grand struggle in search of truth; and the discovery of truth in things, if not easy, is ultimately sure of attainment, since harmony is its sign, and its opposite, the false, is certain of exposure through its native deformity; for however alluring a lie may be made to appear in the abstract, in the concrete it is an unmasked abomination.

From the false the artisan intuitively shrinks. He can only succeed by finding the truth, and embodying it in some useful or beautiful thing which will contribute to the comfort or pleasure of man. Hence his watchword is utility, or, beauty in utility. Of the engrossing character of this struggle the story of Bernard Palissy affords a splendid illustration. Palissy was an artist, a student, and a naturalist, but poor, and compelled to follow the profession of surveying to support his family. At the age of thirty he saw an enamelled cup, of Italian manufacture, which fired his ambition. Ignorant of the nature of clays, he nevertheless resolved to discover enamel, and entered upon a laborious course of investigation and experiment with that end in view. After many years of Herculean effort and indescribable privation, which beggared and estranged his family, and rendered him an object of ridicule among his neighbors, he achieved a grand success. At a critical period of his experiments, in the face of the indignant protests of his almost starving family, having exhausted his credit to the last penny, he consigned to the flames of his furnace the chairs, tables, and floors of his humble cottage, and continued to watch his chemicals with all-absorbing attention, while his wife in despair rushed into the streets and made loud proclamation of the scandal.

But Palissy was more than a potter; he was a Christian, a philosopher, and an austere reformer. Notwithstanding he had been petted and patronized as an ingenious artisan by the royal family of France, he was finally cast into prison under charge of heresy. It was there that the remarkable interview with King Henry III. occurred, which immortalized Palissy as a hero. "My good man," said the king, "you have been forty-five years in the service of the queen, my mother, or in mine, and we have suffered you to live in your own religion, amid all the executions and the massacres. Now, however, I am so pressed by the Guise party and my people that I have been compelled in spite of myself to imprison these two poor women and you." "Sire," answered the old man, "the count came yesterday on your part, promising life to these two sisters upon condition of the sacrifice of their virtue. They replied that they would now be martyrs to their own honor as well as for the honor of God. You have said several times that you feel pity for me; but it is I who pity you, who have said, 'I am compelled!' That is not speaking like a king. These girls and I, who have part in the kingdom of heaven—we will teach you to talk royally. The Guisarts, all your people, and yourself, cannot compel a potter to bow down to images of clay!"* And Palissy the potter and heretic, at the age of seventy, died in the Bastile, proudly defying a king.

The more absorbing the struggle for the discovery of truth becomes, the less room there is in the mind of man for selfishness; and as selfishness recedes, justice assumes its appropriate place as the controlling element in human conduct. The hero is an honest man, that's all.

"Though love repine, and reason chafe,
There comes a voice without reply;
'Tis man's perdition to be safe,
When for the truth he ought to die."

If all men were heroes—honest—there would be no occasion for heroism. If all education can be made scientific, all men can be made honest. The struggle to find truth is more natural than the struggle to succeed regardless of, or against, truth. The reason why what we call heroism appears so grand is this: the standards of public judgment become so perverted by long custom in the abuse of truth that normal conduct appears strange.

When Palissy burned his chairs and tables in the cause of art, his family and his neighbors derided him, and denounced him as a madman, and in prison the king urged him as a friend to save himself from death by recanting his assertion of the right of freedom of religious opinion. Palissy was a hero neither to his family, his friends, nor his king;† but he was right, and his discovery and his

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* "Palissy the Potter," Vol. II., pp. 187, 188. By Henry Morley. Boston: Ticknor, Reed & Fields, 1853.

† "I had nothing but reproaches in the house; in place of consolation, they gave me maledictions. My neighbors, who had heard of this affair [the failure of an experiment], said that I was nothing but a fool, and that I might have had more than eight francs for the things that I had broken; and all this talk was brought to mingle

firmness rendered him immortal. We now know, three hundred years farther down the course of time, that Palissy's struggle over the furnace in the cause of art was mentally and morally normal, while the opposition he encountered was abnormal; and that his defiance of the king was mentally and morally normal, while his persecution was abnormal and cruel.

Palissy's mind was trained naturally in the direction of rectitude, while the minds of the millions of men who permitted him to die unfriended, a prisoner in the Bastile, were developed unnaturally. Their education was unscientific, and their characters were hence deformed. The one symmetrical character was that of Palissy, the lover of truth, who was ready to starve, if need be, for his art, and ready to die for his faith. The thin ranks of the so-called heroes of the ages of history constitute the measure of the poverty of the systems of education that have prevailed among mankind. These so-called heroes are merely normally developed men — men who search for the truth, and having found it, honor it always and everywhere. They are peculiar to no clime, to no country, to no age. They are cosmopolitan, and the fact that they are honored after death by succeeding ages is proof positive of the world's progress, or rather of the progress of moral ideas.

The civilization of Italy in the middle of the fifteenth century presents the most violent possible contrast to that of America in the last half of the nineteenth century. But the one produced Savonarola, the hater of abuses in the Roman Catholic Church, and the other

with my grief."—"Palissy the Potter," Vol. I., p. 190. By Henry Morley. Boston: Ticknor, Reed & Fields, 1853.

John Brown, the stern, uncompromising hater of human bondage. Four hundred years is a long period in the history of civilization, but the priest of the fifteenth century, and the farmer of the nineteenth, are as near of kin in spirit as if they had been born of the same mother, and reared in the same moral atmosphere.

The true hero is always inexorable—as Savonarola in the presence of the majesty of a dying, remorse-stricken, half-repentant prince, and John Brown in the presence of his exultant but half-terrified captors. When Lorenzo di Medici lay terror-stricken, on his death-bed, Savonarola demanded of the dying prince, as the price of absolution, a restoration of the liberties of the people of Florence; and this being refused, the priest departed without one word of peace.

When John Brown, wounded and bleeding, lay a captive at Harper's Ferry, listening to the taunts of angry Virginians, he said, calmly and firmly, "You had better—all you people of the South—prepare yourselves for a settlement of this question. It must come up for settlement sooner than you are prepared for it, and the sooner you commence that preparation the better for you. You may dispose of me very easily—I am nearly disposed of now—but this question is still to be settled—this negro question, I mean. The end of that is not yet."*

There is nothing grander in history, whether real or mythological, than the picture of the humble priest of the fifteenth century, with no power except the justice of his cause, shaking thrones and making proud prelates, and even the Pope himself, tremble with fear! And the

* "The Public Life of Captain John Brown," p. 283. By John Redpath. Boston: Thayer & Eldridge, 1860.

exact parallel of this picture is found, four hundred years down the stream of time, in the person of the farmer, John Brown, defying the Constitution, law, and public sentiment of his country in the interest simply of the cause of justice.

It has been shown through citations from the Walton report, as well as by the opinions of many competent witnesses, that the New England system of education, whether correct in theory or not, is, in actual operation, very defective. But at the time of its establishment it was the best system in existence. To it this country owes the quality of its civilization. The neglect of education by the Government of the United States is the most astonishing fact of its history. It is incomprehensible how, with a comparatively excellent educational system in operation, and in full view in the New England, Middle, and Western States, the National Government could calmly and inactively contemplate the almost entire neglect of popular education in the States of the South, and ignore, from year to year, the steadily accumulating horrors of ignorance and vice which were destined to lead to such deplorable political and social results.

The difference between the civilization of New England and that of South Carolina, for example, is exactly measured by the difference between their respective educational systems. New England undertook, at a very early day, to educate every class of its citizens; South Carolina made a monopoly of education, confining it to a single class.

It must be admitted that the American statesmanship of the whole period of our history has been scarcely less short-sighted than that of England under the Georges, which resulted in saddling upon her people a debt that they can never pay. If England had provided a comprehensive and scientific system of popular education at the beginning of the eighteenth century, who doubts that the wars through which her debt was incurred would have been averted? If the Government of the United States had compelled the adoption of a scientific educational system by the States of the South, who doubts that slavery would have peaceably passed away, and the occasion for war passed away with it?

The conspicuous failure of American statesmanship consists in a failure to appreciate the value of scientific education. It shows that good citizenship is impossible without good education—for good education and good citizenship are convertible terms. And it is easy to show, by the past, that to hesitate on the subject of education is to be lost.*

Why do we provide for popular education? Is it out of pure generosity that the rich citizen consents to be taxed to pay for the education of his poor neighbor's children? Does the man who has no children willingly surrender a portion of his estate for the education of the children of others, as an act of benevolence? Not at all. There is no security for property in a community devoid of education and consequent intelligence. Intelligence alone confers upon property a sacred character. In one

* "If you examine into the history of rogues, you will find that they are as truly manufactured articles as anything else, and it is just because our present system of political economy gives so large a stimulus to that manufacture that you may know it to be a false one. We had better seek for a system which will develop honest men than for one which will deal cunningly with vagabonds. Let us reform our schools, and we shall find little reform needed in our prisons."—"Unto This Last," p. 50. By John Ruskin. New York: John Wiley & Sons, 1883.

of two ways only can property be rendered secure in the owner's hands. It may be protected by a hired soldiery, through the force of arms, or through the force of a public sentiment enlightened by education. The reason why the poor but educated citizen would not lay violent hands on the rich citizen's property is the fact that he indulges the intelligent hope of himself acquiring property. Besides, the morals of a community are in the ratio of its intelligence. The indulgence of hope promotes self-esteem, and self-respect, and these qualities react upon the moral nature.

It should be borne in mind that while one of the main purposes of all governments is to preserve property rights, nearly all the governments of history have been shattered in pieces in the effort to fulfil this function of their existence. It may be said that there is never anything sacred about property unless it is honestly acquired. All the force of our own government was exerted in a vain effort to protect property in slaves. England has been compelled to disturb the property rights of the Irish landlords, and this is only the prelude to an attack upon the property rights of her own landlords. It was the ignorance of the English people hundreds of years ago that permitted the establishment of a land system which is now about to crumble in pieces, and in its fall wreck certain property rights.

There is nothing sacred about property unless it is honestly acquired and honestly held; and property can only be honestly acquired and honestly held, in communities intelligent enough to guard its acquisition, and continued possession, by just and adequate laws. It follows that education is the sole bulwark of the State, and so of property.

The question of the first consequence is, therefore, always, What is the best system of education? It is obvious, also, that the subject of cost should not enter into the discussion; that the best education is the cheapest, is an indisputable proposition. We have seen that the New England system of education, which has spread over the whole country, is very much better than the system which prevailed in those States of the Union where slavery continued to exist down to 1864. But we have seen, also, that that system is very defective; that it is automatic, and hence not natural, not practical, not scientific. It does not produce great merchants, great lawyers, great judges, or great legislators. That it does not, is abundantly shown by the fact that in mercantile life there are ninety-three to ninety-seven failures in every one hundred experiments; by the fact that there is notoriously a general failure of justice; and by the fact that here, as in Great Britain, the chief business of statesmen is the undoing of vicious legislation.

There is a system of training which produces a much higher average of culture than that of the public schools and the universities. We allude to the training received by the students of special mechanical and technical institutions, and by the apprentices in trade-shops. The proof of this is found in the world's railways, ships, harbors, docks, canals, bridges, telegraph and telephone lines, and in a thousand and one other manifestations of skill in art. In the adaptation of means to an end, and in nicety of construction, the mechanic and the civil engineer show, in innumerable ways, with what thoroughness both their minds and their hands have been trained. If mercantile operations were governed by such excellent rules in projection, and by such precision in execution, ninety-seven merchants in a hundred would not go to the wall.

A story has lately gone the round of the public prints to the effect that, during a visit to a needle factory by the Emperor of Germany, a workman begged a hair of his head, bored an eye in it, threaded it, and handed it back to the monarch, who had expressed surprise that eyes could be bored in the smaller sizes of needles. It does not matter whether or not this story is literally true; it illustrates the delicacy of modern mechanical operations. Hundreds of similar illustrations might be given, showing how marvellously skilful the hand has become.

It is not claimed that the hand is a nicer instrument than the mind. As a matter of fact, in drilling the hole in the hair the mind and the hand work together—the mind directs the hand, we will say. The mind devises or invents a watch—every wheel, pinion, screw, and spring—and directs the hand how to make it, and how to set it up, and it ticks off the time. Why does the mind succeed so admirably when it employs the hand to execute its will, but so ill when it devises and attempts, itself, to execute? How is it that the mind invents a watch which, being made by the hand, records the hour to a second, ninety-nine times in a hundred, but fails ninety-three to ninety-seven times in a hundred to devise and carry into execution a mercantile venture? How is it that the mind invents a steam-engine consisting of a hundred pieces, so that, each piece being made by a different hand, the machine shall, when set up, ninety-nine times in a hundred, at once perform the work of five hundred horses without strain or friction, but when it grapples with law and fact in the chair of lawyer or judge produces a most pitiable wreck of justice? How is it that the mind devises and the hand executes with such nice adaptation of means to the end in view, a bridge, that resembles a spider's web, and yet bears thousands of tons and endures for ages, but when it undertakes to legislate evolves statutes that wear out in a year? The first iron bridge constructed spanned the Severn, in England. It was opened to traffic a hundred years ago, but it is still a stanch structure likely to stand for centuries. Where are the English statutes of that time? Repealed to give place to a long line of others which in turn have been repealed. When the famous iron bridge across the Severn was constructed, English legislators were passing bills to compel the American colonies to trade only with the mother country, and to tax them without their consent. Lord Sheffield said, with charming frankness, that the colonies were founded with the sole view of securing to England a monopoly of their trade; and Lord Chatham declared that they would not be permitted to make even a nail or a horseshoe.

In 1516 Sir Thomas More denounced the criminal law of England, declaring that "the loss of money should not cause the loss of man's life."* But this humane and enlightened sentiment had so little weight that during the reign of Henry VIII. seventy-two thousand thieves were hanged—at the rate of two thousand a year. In 1785 twenty men were executed in London at one time for thefts of five shillings. The Lord Chief-justice and the Lord Chancellor agreed that it would be dangerous to repeal the law punishing pilfering by youths. In 1816 the Commons passed a bill abolishing capital punishment for shoplifting—stealing the value of five shillings—but the Lords defeated it, Lord Ellenborough, Chief-justice,

* "The History of England," Vol. II., p. 83. By Harriet Martineau. Philadelphia: Porter & Coates.

observing, peevishly, "They want to alter these laws which a century has proved to be necessary, and which are now to be overturned by speculation and modern philosophy."*

The cause of these failures—of mercantile ventures, of justice, and of legislation — is this: Subjective mental processes are automatic, and hence they neither generate power nor promote rectitude; they enfeeble rather than energize the brain. Men whose characters are formed by such educational processes never originate anything. They become selfish, they venerate the past, their eyes are turned backward; hence, if they sometimes make a feeble effort to move forward they stumble. The lawyer, the judge, and the legislator are examples of this class. Their guide-books are musty folios in a dead language; they look for "precedents" in an age whose civilization perished with its language, and whose maxims and rules of life were long ago exploded. Such men can be compelled to move forward only by the lash of public opinion. Buckle, speaking of the reforms extorted from the legislators of England, says,

"But it is a mere matter of history that our legislators, even to the last moment, were so terrified by the idea of innovation that they refused every reform until the voice of the people rose high enough to awe them into submission, and forced them to grant what without such pressure they would by no means have conceded."†

On the other hand, the inventor, the discoverer, and the artisan are always in the advance, and always moving

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* "The History of England," Vol. II., p. 85. By Harriet Martineau. Philadelphia: Porter & Coates.

† "History of Civilization," Vol. I., p. 361. By Henry Thomas Buckle. New York: D. Appleton & Co., 1864.

forward. They never look back except to catch the vital principle of the invention or discovery of yesterday for utilization in the improved machine of to-day. Their acts are never repealed because they never become odious. They never become odious because they contain the germs of imperishable truth. They are never false; they are suitable to their time and the stage of development; they constitute links in the chain of progress. While the legislator is horrified at the thought of innovation, the inventor, the discoverer, and the artisan are electrified by the discovery of a new principle in physics, and delighted at its application in a new invention, and its practical operation in a new and useful machine.

The difference in effects upon the mental and moral nature, between purely mental training and mental and manual training combined, is susceptible of logical explanation. It is only in things that the truth stands clearly revealed, and only in things that the false is sure of exposure.* Hence exclusively mental training stops far short of the objective point of true education. For if it be true that the last analysis of education is art, progress can find expression only in things—in the work of men's hands. And it is true; for ideas are mere vain speculations until they are embodied in things. Nor is

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* "To know the truth it is necessary to do the truth." . . .

"We rightly seek the meaning of the abstract in the concrete, because we cannot *act* in relation to the abstract, which is only a representative sign; we must give it a concrete form in order to make it a clear and distinct idea; until we have done so we do not know that we really believe—only believe that we believe it. A truth is best certified to be a truth when we live it and have ceased to talk about it."—"Body and Will," p. 49. By Henry Maudsley, M.D. New York: D. Appleton & Co., 1884.

this materialism unless all civilization is material; for the prime difference between barbarism and civilization consists in the presence, in a state of civilization, of more things of use and beauty than are found in a state of barbarism. To exalt things is not materialistic; they are both the source and issue of ideas, and the measure of civilization. Ideas and things are hence indissolubly connected; and it follows that any system of education which separates them is radically defective.* Exclusively mental training does not produce a symmetrical character, because at best it merely teaches the student how to think, and the complement of thinking is acting. Before thoughts can have any influence whatever upon the world of mind and matter external to the mind originating them they must be expressed. They may be expressed feebly, through the voice, in words; more durably, and therefore more forcibly, with the pen, on paper; more forcibly still in drawing—pictures of things; and, with the superlative degree of force, in real things.

The object of education is the generation of power.

* "Prof. Huxley seems to hold that zoology cannot be learned with any degree of sufficiency unless the student practises dissection. In support of this position there are strong reasons. In the first place, the impression made on the mind by the actual objects, as seen, handled, and operated upon, is far beyond the efficacy of words or description. And not only is it greater, but it is more faithful to the fact. While diagrams have a special value in bringing out links of connection that are disguised in the actual objects, they can never show the things exactly as they appear to our senses; and this full and precise conception of actuality is the most desirable form of knowledge; it is truth, the whole truth, and nothing but the truth. Moreover, it enables the student to exercise a free and independent judgment upon the dicta of the teacher."—"Education as a Science," p. 303. By Alexander Bain, LL.D. New York: D. Appleton & Co., 1884.

But to generate and store up power, whether mental or physical, or both, is a waste of effort, unless the power is to be exerted. Why generate steam if there is no engine to be operated? Steam may be likened to an idea which finds expression through the engine — a thing. Why store the mind with facts — historical, philosophical, or mathematical—which are useless until applied to things, if they are not to be applied to things? And if they are to be applied to things, why not teach the art of so applying them? As a matter of fact, the system of education which does not do this is one-sided, incomplete, unscientific. Rousseau says, "Education itself is certainly nothing but habit." If this be true, it will be conceded that the habit of expressing ideas in things should be formed in the schools, because the chief way in which man is benefited is through the expression of ideas in things. The system of education which tends to form this habit is that of the kindergarten and that of the manual training school. These systems are one in principle. They are not new; they at least date back to Bacon, who declared that he would "employ his utmost endeavors towards restoring or cultivating a just and legitimate familiarity betwixt the mind and things." The kindergarten and the manual training school exactly realize Bacon's idea. The idea of the manual training school was in the mind of Comenius when he said, "Let things that have to be done be learned by doing them." It was in the mind of Pestalozzi when he said, "Education is the generation of power." It was in the mind of Froebel, not less than the kindergarten, when he said, "The end and aim of all our work should be the harmonious growth of the whole being."

These are excellent definitions of education, and they are sequential. If things that have to be done are learned by doing them, there will be in the course of the process a wholesome exercise of both body and mind, and this exercise will result in the generation of power —power to think well, and to do well; and the process being continued, the result cannot fail to be the harmonious growth of the whole being. This is scientific, as opposed to automatic, education.*

* "Intellectual progress is of necessity from the concrete to the abstract. But regardless of this, highly abstract subjects such as grammar, which should come quite late, are begun quite early. Political geography, dead and uninteresting to a child, and which should be an appendage of sociological studies, is commenced betimes, while physical geography, comprehensible and comparatively attractive to a child, is in great part passed over. Nearly every subject dealt with is arranged in abnormal order—definitions and rules and principles being put first, instead of being disclosed, as they are in the order of nature, through the study of cases. And then, pervading the whole, is the vicious system of rote learning—a system of sacrificing the spirit to the letter. . . .

"A leading fact in human progress is that every science is evolved out of its corresponding art. It results from the necessity we are under, both individually and as a race, of reaching the abstract by way of the concrete, that there must be practice and an accruing experience with its empirical generalizations before there can be science."—"Education," pp. 61, 124. By Herbert Spencer. New York: D. Appleton & Co., 1883.

CHAPTER XXI.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

EGYPT AND GREECE.

Fundamental Propositions.—Selfishness the Source of Social Evil; Subjective Education the Source of Selfishness and the Cause of Contempt of Labor; and Social Disintegration the Result of Contempt of Labor and the Useful Arts.—The First Class-distinction—the Strongest Man ruled; his First Rival, the Ingenious Man.—Superstition.—The Castes of India and Egypt—how came they about?—Egyptian Education based on Selfishness.—Rise of Egypt—her Career; her Fall; Analysis thereof.—She Typifies all the Early Nations: Force and Rapacity above, Chains and Slavery below.—Their Education consisted of Selfish Maxims for the Government of the Many by the Few, and Government meant the Appropriation of the Products of Labor.—Analysis of Greek Character—its Savage Characteristics.—Greek Treachery and Cruelty.—Greek Venality.—Her Orators accepted Bribes.—Responsibility of Greek Education and Philosophy for the Ruin of Greek Civilization.—Rectitude wholly left out of her Scheme of Education.—Plato's Contempt of Matter: it led to Contempt of Man and all his Works.—Greek Education consisted of Rhetoric and Logic; all Useful Things were hence held in Contempt.

It is a fundamental proposition of this work that selfishness is the essence of depravity, and hence the source of all social evil; and in previous chapters it has been shown, argumentatively, that exclusively subjective processes of education tend, in a high degree, to promote selfishness. Another fundamental proposition of this work is that the useful arts are the true measure of civilization, and that, as they are the product of labor, contempt of the laborer leads inevitably to social disintegration and the destruction of the State. If these propositions are true, the solution of all social problems is to be sought through a radical change in educational methods. If they are true, it is of the first importance that they be proved, not only by argument, but by the citation of such facts of history as bear upon the subject. Civilization is the product of education. If the education is good the product will be good, if evil the product will be evil. The purpose of this and the four following chapters is, therefore, to trace the progress of civilization, to sketch in bold outline the social history of man.

The aphorism, all men are created equal, is a fine phrase, but its truth is reserved for realization by the civilization of the future. A tendency to the formation of class-distinctions in human society, whether savage or civilized, is disclosed by all history.

The first class-distinction sprang from the physical superiority of one savage over his fellows. He whose powerful frame and commanding eye enabled him best to cope with the beasts of field and forest became chief of the tribe. He held the first place by virtue of his brawny arm, and the less athletic, and more timid, became his subjects. But he was not long without rivals. His first rival was the dwarf, or hunchback, who, brooding moodily over the misfortune of his deformity, in the seclusion of his mud hut, invented the stone hatchet and stone-pointed arrow-head. His next rival was the puny, pale-faced youth who converted pantomimic signs and rude gestures into a language of sounds, and so armed communities with the power of combination for mutual protection. Those who soonest mastered the first alphabet took high rank in the social circle, while those who could still only make themselves understood by grimaces and gestures fell to the grade of ciphers in the body politic, and came to be looked upon as dunces in society. Thereafter the women, who had previously been won as wives by personal prowess, were more equally parcelled out. The savage who had invented the bow and the arrow was exempted from the toils of the chase, and from the general contention at the courting season; a wife was assigned to him, and his tent was supplied with game in the hope that he would invent some other useful thing. Thus mind began to assert its empire over matter, the division of labor commenced, and a class-distinction was formed. Doubtless the youth who invented language cultivated superstition among the ignorant, and so, increasing his already considerable influence, secured the first social rank. Hence the castes of India and Egypt, consisting, in their order, of the priesthood, the army, the mercantile class, and, at the bottom of the scale, the servile laborer.

Of the long period of social progress from a state of savagery to the high civilization of historic Egypt the record is faint and fragmentary. Ages passed, during which men struggled, and died, and left no sign — neither hieroglyphic character, monument, nor buried city. Through what mental alchemy was the savage chief transformed, in the course of hundreds of generations, into the learned, accomplished, and astute Egyptian priest, from whose courtly lips Herodotus received the chronicles of the Egyptian kings and the romantic story of the residence in Egypt of Helen of Troy?* How were the members of the savage tribe converted, one into an obedient soldier, another into an adroit, self-seeking merchant, and

* "Herodotus, 'Euterpe,'" II., pp. 112–116. New York: Harper & Brothers, 1882.

another into a cringing slave? These are secrets of antiquity, destined, doubtless, to remain forever unrevealed. We do know, however, that the civilization of Egypt, like all other civilizations, was the product of training or education; and the nature of the education may be inferred from the character and fate of the civilization.

Of the Egyptian system of education selfishness was the basis. Given chains and slavery for the lowest class and there were force and rapacity in the highest class.* Before the free-born savage was reduced to slavery and made to toil under the lash, whole hecatombs of lives were sacrificed. Before the mind of the savage was degraded to the baseness of slavery, his body, hacked and hewn, bent submissively to the scourge. For the Egyptian boy there was, doubtless, a "Poor Richard's Almanack," which taught him that he must "look to the main chance;" that "in the race of life the devil takes the hindmost;" and that "self-preservation is the first law of nature." Thus trained he entered the ranks of the priesthood, one of his brothers took a commission in the army, and the others embarked in mercantile life. For the servile class there was no education beyond their several occupations. Each man was compelled to follow the trade of his father, to marry within his own class, to die as he was born.

Ruled by the priests, and the army, Egypt grew rich. Her commerce, conducted by means of caravans, embraced the whole civilized world and included all its products. She became a great military and naval power, her armies overrunning Asia, and her fleets sweeping the Indian

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* "The Martyrdom of Man," p. 18. By Winwood Reade. New York: Charles P. Somerby, 1876.

Ocean. Her victorious campaigns opened new markets to her commerce, and through these channels wealth poured into the empire. In the track of the wheels of the Egyptian war-chariots the Egyptian merchant quickly followed. At the point of the arrows of her archers she offered her linen goods to conquered peoples, as England, at the point of the bayonet, subsequently offered her cotton goods to prostrate India.

In Egypt all the learning of the time was concentrated. It was the university of Greece. Every intellectual Greek made a voyage to Egypt; it was regarded as a part of education, as a pilgrimage to the cradle-land of their mythology. The possession of great wealth led to habits of luxury. The house of the Egyptian gentleman was a palace adorned with the triumphs of art, and devoted to pleasure. Its walls, its floors, and its furniture reflected the skill, not to say genius, of slaves—for all the manual labor of Egypt was performed by slaves. At the end of the fashionable dinner, given in the palace by its rich master, a mummy, richly painted and gilded, was presented to each guest in turn by a servant, who said, "Look on this; drink and enjoy thyself, for such as it is now so thou shalt be when thou art dead."*

One day when the priests were sacrificing in the temples, and the chief officers of the army were dining with a contractor for army supplies, a band of mountaineers rushed out of the recesses of Persia and swept like a wind across the plains. They were dressed in leather; they had never tasted fruit nor wine; they had never seen a market; they knew not how to buy or sell. They

* "Herodotus, 'Euterpe,'" II., p. 78. New York: Harper & Brothers, 1882.

were taught three things—to ride on horseback, to hurl the javelin, and to speak the truth.* All Asia was covered with blood and flames. The allied kingdoms fell at once, and India and Egypt were soon afterwards added to the Persian empire.

Egypt typifies all the early nations. In its rise, progress, and fall, the course of the others may be traced. First there is a band of hardy men whose prowess renders them irresistible. They are inured to toil; they practise all the manly virtues; they are trained to labor with their hands; they are taught to speak the truth. They lay the foundations of the State in industry and prudence; their children develop its resources; their children's children, through many generations, gradually accumulate wealth. The arts flourish, and luxuries are multiplied. There are many great estates, and those who inherit them cease to labor, and, ceasing to labor, they become a charge upon the public; for the value of an estate created one hundred years ago, or one year ago, can be maintained in no other way than by the labor of to-day.† The idlers increase in number, and the struggle for existence, of the workers, becomes more intense. Idle-

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* "Herodotus, 'Clio,'" I., pp. 71, 136, 153. New York: Harper & Brothers, 1882.

† "It is not equitable that what one man hath done for the public should discharge another of what it has a right to expect from him; for one, standing indebted in himself to society, cannot substitute anything in the room of his personal service. The father cannot transmit to his son the right of being useless to his fellow-creatures. . . . The man who earns not his subsistence, but eats the bread of idleness, is no better than a thief. . . . To labor, then, is the indispensable duty of social or political man. Rich or poor, strong or weak, every idle citizen is a knave."—"Emilius and Sophia," Vol. II., pp. 92, 93. By J. J. Rousseau. London: 1767.

ness breeds vice, and the public morals are debauched. We see this class at the feast of Belshazzar and at the dinner of the Egyptian *bon vivant.* On the wall of every such banqueting room there is an ominous handwriting, provided, only, that there is a Daniel to interpret it. It means that the nation that degrades labor, tolerates idleness, and deifies vice, is ripe for annihilation. If, now, there is on the frontier of the effete nation a virile people, it is only a question of time and opportunity, when they will make slaves of the revellers, and spoil of their inherited estates. The worn-out, exhausted nation disappears in blood and flames. The rich idler, the poor sycophant, the rulers and the ruled, the slave and his master, the priest, the soldier, the merchant, and the laborer, all go to destruction together.

In the ancient nations there was always force and rapacity above, and chains and slavery below. Education was confined to a small class, and consisted of selfish maxims for the government of the many, and government was only another name for the appropriation of the products of their labor. Selfishness bred injustice, and the practice of injustice undermined the State. Whether the State survived or fell was a matter of indifference to the slave. A slave he remained in any event—if not of the Egyptian then of the Persian. But the importance of labor is shown by those bloody revolutions. The battles of antiquity were contests for the possession of the labor class. Which nationality—the Egyptian or the Persian—should drive the toilers to their daily tasks; which should reap the fruit of the sweat of their brows; which should buy and sell them; which scourge them to their dungeons? These were the questions which agitated the minds of ancient rulers. They were the questions which agitated the mind of Xerxes when he invaded Greece, with millions of followers, to encounter defeat at the hands of a few thousand men of a superior type.

The Greek civilization sprung from mythology and ended in anarchy. In the East the Greeks were called the people of youth. Their religion was of the savage type. Their gods were immortalized men; they loved and hated, transgressed and suffered; they resorted to stratagems to compass their ends; they were a kind of exalted but unscrupulous aristocracy.

Greek patriotism was narrow; each city was politically independent, and the citizen of one city was an alien and a stranger in the territory of every other. The Greeks were superstitious. If the omens were unfavorable the general refused to give battle; the plague was a visible sign of the wrath of the gods; the priests sacrificed perpetually; the oracle of Apollo outlived Grecian independence hundreds of years.

Grecian national festivals were childish, consisting of wrestling, boxing, running, jumping, and chariot-racing. But the victor in those games conferred everlasting glory upon his family and his country, and was rewarded with distinguished honors.

Like savages, the Greeks were treacherous. The destiny of Greece was controlled by renegades. There was disloyalty in every camp, a Greek deserter in every opposing army, and a traitor, or a band of traitors, in every besieged Greek city. They were cruel; of their captives they butchered the men and enslaved the women, and they stripped and robbed the bodies of the slain, on the battle-field. Like savages they assassinated ambassadors, and like savages surrendered prisoners to their personal enemies to be massacred. Their sense of honor was dull.

Xenophon, after winning imperishable renown, in conducting the famous retreat of the "Ten Thousand," led a detachment of them on a pillaging expedition, and so amassed a fortune. "My patriotism," says Alcibiades, "I keep not at a time when I am being wronged." "For there was neither promise that could be depended on, nor oath that struck them with fear," exclaims Thucydides.*

Venality was the predominating trait in Greek character, and venality unrestrained is savagery. In the Greek Pantheon the highest niche was reserved for the God of Gain. The early Greeks were pirates; they plundered one another; they sometimes actually sold themselves into slavery, so great was their lust of gold. The richest cities ruled the poor cities. Pericles boasted that he could not be bribed, but he robbed all Greece to embellish Athens, and was accused of peculation, tried, convicted, and fined. The Athenians declared that the Spartans were taught to steal, and the Spartans retorted that the best Athenians were invariably thieves. When Persia could no longer fight she defended her territory against Greek invasion with gold coins.

The Greek orators never refused a bribe, and oratory ruled Greece. Greek oratory was very persuasive. A discriminating writer declares that, with their fine phrases and rhetorical expressions, the Greek orators swindled history, obtaining a vast amount of admiration under false pretences.†

For these defects in Greek character, and for the re-

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* "The History of the Peloponnesian War," Vol. I., p. 210. London: George Bell & Sons.

† "The Martyrdom of Man," p. 88. By Winwood Reade. New York: Charles P. Somerby, 1876.

sulting decay of Greek civilization, Greek philosophy and Greek education must be held responsible. Metaphysics and rhetoric ruined Greece. It was in the schools of rhetoric that the young Greeks received their training for the duties of public life. There they were taught the art of oratory; there they learned how to make the worse appear the better reason. There they were taught, not to expound the truth, but to indulge in the arts of sophistry. It was in those schools that the young Greek was trained to be eloquent, to win applause in the courts of law, not to convince the judgments of judge, or juror; for judicial decisions were notoriously subjects of the most shameful traffic.

The element of rectitude was wholly left out of the Greek system of education, and hence wholly wanting in Greek character. The Greeks had a profound distrust of one another. They were dishonest; they were treacherous; they were cruel; they were false; and all these vices are peculiar to a state of savagery. In ethics they never emerged from the savage state, and hence in politics their failure was complete; for the prime condition of the most simple form of civil society is mutual confidence. But the mutual distrust of the Greeks, based on want of integrity, was so absolute that political unity was impossible, and the failure to combine the several cities under one government led, eventually, to the destruction of Greek civilization.

To this result Greek philosophy also contributed. Plato's contempt for matter was so profound that he regarded the soul's residence in the body as an evil. He taught that the philosopher should emancipate himself from the illusions of sense, devoting his life to reflection, and surrendering his mind "to communion with its kindred eternal essences." Contempt of matter led logically to contempt of the physical man, and hence to contempt of things, the work of man's hands. Such a philosophy was necessarily "in the air." It afforded no aid to the sciences; for science is the product of generalizations from matter. It scorned art; for the arts are applications of the sciences in useful things. With the Greek schoolmaster rhetoric was the chief part of education; with the Greek philosopher dialectics was the science *par eminence.*

Thus the Greek system of education was confined to rhetoric and logic—the art of speaking with propriety, elegance, and force, and the power of deducing legitimate conclusions from assumed premises. In the Greek schools of rhetoric there was no struggle to find the truth; in the schools of philosophy there was no respect for the evidence of the senses. The Greek orator harangued the jury eloquently while his client bargained with the court for the price of justice! The Greek philosopher confounded his audience with the force of his unanswerable logic, and appealed to his inner consciousness in support of the soundness of his premises!

The explanation of Greek duplicity is found in Greek metaphysics. To scorn things is to disregard facts, and disregard of facts is contempt of the truth. Greek education was confined to a consideration of the subject of the nature and relations of abstract ideas, while the subject of the nature and relations of things was wholly neglected. Such a system of education led logically to selfishness, and out of selfishness grew inordinate ambition and greed; and these passions led, through treachery and dishonesty, to factional contests, which, eventuating in bloodshed, could only end in anarchy. Distracted by the jealousies and rivalries of States constantly in hostile conflict, and enfeebled by the never-ending strife between the rich and the poor, Greece fell a prey to the rapacity, and lust of power, of her unscrupulous Roman neighbor.

CHAPTER XXII.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

ROME.

Vigor of the Early Romans—their Virtues and Vices; their Rigorous Laws; their Defective Education; their Contempt of Labor.—Slavery: its Horrors and Brutalizing Influence.—Education Confined to the Arts of Politics and War; it transformed Courage into Cruelty, and Fortitude into Stoicism.—Robbery and Bribery.—The Vices of Greece and Carthage imported into Rome.—Slaves construct all the great Public Works; they Revolt, and the Legions Slaughter them.—The Gothic Invasion.—Rome Falls.—False Philosophy and Superficial Education promoted Selfishness.—Deification of Abstractions, and Scorn of Men and Things.—Universal Moral Degradation.—Neglect of Honest Men and Promotion of Demagogues.—The Decline of Morals and Growth of Literature.—Darwin's Law of Reversion, through Selfishness, to Savagery.—Contest between the Rich and the Poor.—Logic, Rhetoric, and Ruin.

In the city of the Seven Hills there was no statue to Pity, as at Athens. In the long line of Roman conquerors there was no one possessing the title to fame, of which, on his death-bed, Pericles boasted, namely, that "no Athenian had ever worn mourning on his account."

The dominion of Rome was logical. In the legend of Romulus and Remus, suckled by the she-wolf, there is a hint of the rugged vigor which characterized the Roman people, and distinguished them from the earlier nationalities. In all the civilizations anterior to that of Rome there was an element of pliability or softness which belongs to the youth of man. But from the day on which Romulus, with the brazen ploughshare, drew a furrow around the Palatine, both the sinews and the souls of his followers hardened into maturity. The rising walls of the city, so the legend runs, were moistened with the life-drops of Remus, whose derisive remark and act cost him his life, his slayer exclaiming, haughtily, "So perish all who dare to climb these ramparts." The rape of the Sabines, the conflicts which ensued with that outraged people, their incorporation with the conquerors, their subsequent joint conquests, and the shrewdness displayed in the conservation of the fruits of victory—these events show that man had attained his majority. Under the shadow of the walls of the Eternal City all the great races were associated and mingled—Latins, Trojans, Greeks, Sabines, and Etruscans. The Roman civilization was the product of all that had gone before, as it was destined to be the father of all that should follow it. The Roman had no peer either in courage or fortitude. Aspiring to universal dominion, he toughened himself to achieve it. Dooming his enemy to death or slavery, he was not less self-exacting, his own life, through the cup of poison, the sword, or the opened vein, becoming the forfeit equally of misfortune and shame. The tragic fate of Lucretia, the resulting revolution, the banishment of the Tarquins, and the abolition of the kingly government show the swiftness of Roman retribution and the terrible force of Roman resolution. Roman persistence in the path of conquest for many centuries is typified by Cato in his invocation of destruction upon Carthage. The masculine character of the Roman vices finds illustration in the struggle of Appius, the Decemvir, to possess the person of Virginia by wresting the law from its true purpose, the conservation of justice, and converting it into a shield for lust; and the vigor of Roman virtue is exemplified in the act of Virginius plunging the knife into the heart of his beloved daughter to save her honor. The rigorous laws of Rome testify to the stamina of her people. The father to whom a deformed son was born must cause the child to be put to death, and any citizen might kill the man who betrayed the design of becoming king.

A scientific system of education would have conserved and developed the noble and eliminated the ignoble traits of Roman character. But neither Roman education, philosophy, nor ethics inculcated either respect for labor or reverence for human rights; and hence the laborer was reduced to slavery, and the slave made the victim of every known atrocity. Slavery became the corner-stone of the Roman State, and slavery and labor were synonymous terms. The Roman supply of laborers was maintained by depopulating conquered countries. In the train of the legions, returning to Rome in triumph, there were not only statues, paintings, and other works of art, but thousands of men, women, and children destined to slavery. And the laws in regard to slaves were terrible, as laws touching slavery must always be—for a state of slavery is a state of war. It was a law of Rome that if a slave murdered his master the whole family of slaves should be put to death; and Tacitus relates an instance of the execution of four hundred slaves for the murder of a citizen, their master. In the course of the servile rebellion in Sicily a million slaves were killed; and it should be borne in mind that they were valuable laborers—many of them skilled artisans. Vast numbers of them were exposed to wild beasts in the arena, for the popular amusement. The rebellion of the gladiators was put down only by a resort to awful atrocities, among which was the crucifixion of prisoners. The revolt of the allies was quelled at the cost of half a million lives. But slaves were plenty, for Rome had her bloody hand at the throat of all mankind, and her hoarse cry was, "Your life or your liberty!"

Every Roman freeman was a soldier, and the cultivation of the land, manufactures, and all the pursuits of industry, were carried on by slaves. Slave labor was cheaper than the labor of animals; cattle were taken from the plough and slaughtered for beef that slaves—men—might take their places. Labor fell to the lowest degree of contempt, and the laborer was a thing to be spurned—for the free citizen to labor with his hands was more disgraceful than to die of starvation. Hence there was a class of citizen paupers to whom largesses of corn were doled out by the demagogues of the Senate and the army. Ultimately these citizen-paupers became so vile and filthy that they engendered leprosy and other loathsome diseases, as they dragged their palsied limbs through the streets of the city, crying, "Bread and circuses! bread and circuses!"

Roman education was confined almost exclusively to the training of the sons of rich citizens in the arts of politics and war; and in a State where labor was despised, and whose corner-stone was slavery, and whose shibboleth was conquest, the baseness of these arts may be imagined but hardly described. It promoted selfishness, and in the course of centuries selfishness transformed Roman courage into cruelty, and Roman fortitude into brutal stoicism. The Roman sense of justice was swallowed up in Roman lust of power. Rome became the great robber nation of the world. She was on the land what Greece had once been on the sea—a pirate.

She made the streets of the cities she conquered run with blood. Thousands of captives she doomed to death; other thousands graced the triumphs of her generals, and the spoil saved from the fury of the flames, and the more ungovernable fury of the licentious soldiery, was carried home to the Eternal City, there to fall into the hands of the most cunning among the demagogues, for use in the bribery of courts, senators, and the populace.

Tacitus deplored the decline of public virtue. He declared, mournfully, that "Nothing was sacred, nothing safe from the hand of rapacity." His environment blinded him to the true cause of the depravity he so eloquently deplored—selfishness. Had he been familiar with the inductive method he would have found in a defective system of education the cause of Roman venality and corruption. He might thus have realized the weakness of a community of men who wanted the necessary force and virtue to depose a Tiberius and elevate to his place a Germanicus; or to dethrone a Domitian and crown in his stead an Agricola.

Education in Rome deified selfishness, and hence realized its last analysis—total depravity. Of course nothing was sacred in a community where men were ruthlessly trampled underfoot! Of course nothing was "safe from the hand of rapacity" where the laborer was degraded to a place in the social scale below the leprous pauper whose filthy person provoked disgust, and whose poisonous breath, as he cried for bread, spread abroad disease and death!

It was inevitable that the nation that grew rich through plunder should grow poor in public and private virtue. And such was the fact. The eagles that protected robbers abroad, spread their sheltering wings over defaulters, bribers, and thieves at home. There had been a time in Rome when bribery was punishable with death, but now candidates for office sat at tables in the streets near the polling-places and openly paid the people for their votes. The change in the habits of the people was as pronounced as the change in the laws. The early triumphs of the Romans were industrial—flocks and herds; their trophies, obtained in single combat, consisted of spears and helmets. When Cincinnatus was sent for to assume the dictatorship he was found in his field following the plough. Valerius, four times consul, and by Livy characterized as the first man of his time, died so poor that he had to be buried at the public charge. But with the fall of Greece and Carthage, and the reduction of Asia, there was a great social change at Rome. The Roman legions not only carried home the wealth of the countries they conquered but the vices of the peoples they subdued. An ancient writer summarizes the situation in the following graphic sentence: "The only fashionable principles were to acquire wealth by every means of avarice and injustice, and to dissipate it by every method of luxury and profusion."

The end is not far off. The story of Persia, of Egypt, and of Greece is the story equally of Rome. Avarice and injustice, luxury and profusion do their sure work. The Roman civilization is more than a thousand years old. Asiatic wealth, the luxury and false philosophy of Greece, and a vicious system of education, promoting selfishness, have united to sap its foundations. Society is divided into three classes—an aristocracy based solely upon wealth, cruel and profligate, a mob of free citizens, otherwise paupers, who live by beggary and the sale of their votes, and laborers who are slaves.

On the occasion of the presentation of spectacles, among a variety of presents slaves (laborers) are thrown into the arena to be scrambled for by the free citizens! But men are cheap. In Asia they sell for sixpence apiece, and Rome has only to send an army there to get them for nothing. To this class, to these slaves, however, the Roman people are indebted for all the arts which make life agreeable. They construct all the great public works. They build the splendid roads over which the Roman legions follow their generals in triumph home to Rome. They make the aqueducts, dig the canals, and construct the buildings, public and private, whose remains still attest their magnificence — the Forum, the amphitheatres, and the golden house of the Cæsars. They build the villas overlooking the Bay of Naples, in which the nobles live in riot and wantonness; they cook the dinners given in those villas; they make the clothes the nobles wear, and the jewels that adorn their persons. They cultivate the fields, follow the plough, train and trim the vine, and gather in the harvest. They raise the corn that is distributed by the nobles among the soldiery, and given as a bribe to the diseased and debauched free citizens for their votes. They feel deeply the injustice of their lot, and, like men, strike for liberty. But the Roman legions are set on them like blood-hounds, and hundreds of thousands of them are slaughtered and made food for birds of prey, and other thousands are thrown into the arena to be torn by wild beasts, and still others are bestowed as gifts upon the populace at the games.

The contest between the rich and the poor is at an end; the rich are millionaires, the poor are beggars. It is the story of Dives and Lazarus over again. The rich are clothed in purple and fine linen, and fare sumptuously every day; the poor are full of sores, and live upon the crumbs that fall from the tables of the rich. Rome topples to her fall. The Gothic invader is at her gates, and there is no army to defend them. The barbarian demands a ransom. To obtain it the statues are despoiled of their ornaments and precious stones, and the gods of gold and silver are melted in the fire. The ransom is given, and Alaric retires. He returns, and this time to pillage. The city is sacked; rich and poor, bond and free, are whelmed in one common ruin. At last the diabolic wish of the infamous Caligula is realized. The Roman people have but one neck, and the Goth puts his foot upon it. Rome falls, the victim of her own crimes, strangled by her own gluttony. Thus ends the first period of the world's manhood—ends in exhaustion, and a syncope which is destined to last a thousand years.

Long before the fall of the republic Rome had become the seat of all the world's learning. In robbing conquered countries she not only took their gold and silver, a share of their people for slaves, and their works of art, but their libraries, their philosophy, and their literature. But neither the Greek nor the Roman philosophy contributed in the least to a solution of the pressing social problems of the time. The wise men of Rome were powerless to help either themselves or their fellow-men, because their philosophy was false. It was purely speculative; it had no body of facts to rest upon.

The Roman educators and philosophers were almost as ignorant of physiology as Plato was hundreds of years before, hence they were unable to study the mind in the sole way in which it is intelligently approachable, namely, through its bodily manifestations. In studying the mind as an independent entity there could be no general rules of investigation. The metaphysical philosopher did not study the mind of man; he explored his own mind merely—consulted his own inner consciousness. Hence there were, in Rome, as many systems of philosophy, more or less clearly defined and distinct, as there were philosophers. But they were merely metaphysical speculations, dreams, dependent upon purely subjective processes; and those processes were in turn dependent upon the ever-changing states of mind of each philosopher.

It is obvious that these systems of philosophy could exert no influence upon the community at large, for the community formed no part of the subject matter of their speculations. But they did exert an influence, and a very pernicious one, upon the philosophers themselves, and indeed upon all the cultured men of Rome; for they were thereby made thoroughly selfish, and so rendered incapable of forming a just judgment of public affairs. In considering the mind apart from the body, the body naturally fell into utter contempt. This was the great crime of speculative philosophy; for in engendering a feeling of contempt for the human body it furnished an excuse for slavery. And this contempt logically included manual labor, for the only manual laborer was a slave; and it also extended to the useful arts, for all those arts were the work of slaves. Hence the laborer, being a slave, was placed lower in the social scale than the pauper who sold his vote for a glass of wine. And thus it came about that a factitious right—the right of suffrage—was more highly esteemed by the public than the cardinal virtue of industry, upon which alone the perpetuity of the social compact depends.

And, again, the wretched state of public morals may be inferred from the fact that the right of suffrage, through which the idle, leprous pauper was elevated above the industrious laborer and above the useful arts, was notoriously the subject of open traffic in the streets of Rome on every election day. Thus Roman philosophy landed the Roman people in the last ditch, for it led to the deification of abstract ideas and to scorn of things. That this utter perversion of the truth and wreck of justice was the cause of the decline of the Roman Empire there is no doubt.

It is equally plain that the noted men of Rome were utterly ignorant of the cause of the disorders which afflicted the body politic. There is no evidence, either in their lives or their works, that they brought to the consideration of the great social problems of the time any practical philosophy whatever. Suetonius, with a graphic pen, portrays the cruelties of the Cæsars, but hints at no cause therefor inherent in the social system. Cicero forecasts the doom of the republic, but has no remedy to propose except that of the elevation of Pompey rather than Cæsar. Livy and Tacitus deplore the decay of public and private virtue, but are silent on the subject of the infamy of slavery and on the shame of degrading labor. The moral sentiments of Seneca and Aurelius are of the most elevated character, but the fact that they ignore slavery, the slave, the laborer, and the useful arts, shows either that they never thought upon those fundamental social questions, or that their thoughts ran in the popular channel; in a word, that their philosophy was so shallow as to render them callous to the great crimes upon which the Roman State rested.

That the subjective philosophy and the defective educational system of the Romans rendered them selfish, and hence corrupt, there is abundant evidence. Cicero professed the most lofty patriotism, but he was without moral courage. It was he who congratulated the public men of Rome, after the usurpation of Cæsar, upon the privilege of remaining "totally silent!" He regarded Pompey as "the greatest man the world had ever produced," but deserted him in his extremity, which was equally the extremity of his country. He denounced Cæsar as the cause of the culminating misfortunes of Rome, but went down upon his knees to him, and rose to his feet only to exhaust all the resources of his matchless eloquence in fulsome adulation of the destroyer of the Republic.

Seneca's moral precepts are sublime, but his political maxims are atrocious. Witness this pretence of an all-embracing love for man—"Whenever thou seest a fellow-creature in distress know that thou seest a human being." Contrast with this exalted sentiment of the great stoic his political maxim — "Terror is the safeguard of a kingdom"—and reflect that he lived under the reigns of Claudius and Nero. The millions of slaves in the Roman dominions were "human beings," but Seneca had no practical regard for them as "fellow-creatures in distress." His beautiful humanitarian sentiment was a barren ideality—it bore no fruit; but his brutal political maxim caused him to thrive. Under the favor of Claudius Seneca amassed a vast fortune. His palace in the city was sumptuously furnished, his country-seats were splendidly appointed, and he possessed abundance of ready money. "There can be no happiness without virtue," exclaims this prosperous Roman citizen. But while Seneca pens this lofty sentiment he is accused of avarice, usury, and extortion, charged with complicity in the Piso conspiracy, and banished for the crime of adultery.

The debasing influence of the Greek philosophy, upon the Roman people, is shown by contrasting the characters of the distinguished men who were honored by the public at widely separated periods of time. Thus, during the period 400–350 B.C., Camillus, noted above all his contemporaries for the purity of his public life, was uninterruptedly honored with the highest offices in the State, and loved and respected by all classes of the community. But three hundred years later Cæsar, who involved the country in civil war to compass his ambition, and in which struggle liberty perished — he was preferred, in all the political struggles preliminary to his assumption of supreme power, to Cato, whose patriotism was unquestioned, and whose rigid virtue was proverbial throughout the Roman Empire. So also of a still later period, Agricola and Germanicus were renowned for the possession of the highest qualities of true manhood, joined to the practice in public life of the most austere and self-sacrificing virtue. Both served the State with courage, ability, and zeal; but the one, after a brilliant career in the West, was forced into retirement, and the other, after splendid services in the East, was exiled and poisoned.

Previous to the introduction of the Greek philosophy, and the Greek education and social habits, the Roman people were worthy of their noblest representative —Camillus. At that early period of their history they rewarded virtue and punished vice. But during the Empire, after the invasion of Greek manners, they were unworthy of their best representatives—Cato, Germanicus, and Agricola. To those great and good men they preferred Cæsar, Caligula, and Nero: they rewarded vice and punished virtue. There is in this circumstance unquestionable evidence of a great declension in character. But the remarkable fact in regard to this period of Roman history is that the declension in character was accompanied by a species of great mental growth or power.

During this period a literature was created which has ever since been famous, and which still exerts a considerable influence upon man. Cæsar's Commentaries, the Orations of Cicero, the Annals of Tacitus, Livy's History, the Odes and Satires of Horace, the Meditations of Aurelius, and the Morals of Seneca are in all the world's libraries, and, in the universities, are placed in the hands of the most favored youth of all the civilized countries of the world, as models of style and exponents of a civilization whence all modern civilizations sprung. But this literature possessed no saving quality, because in so far as it was elevated in morals it did not represent the Roman people, not even the authors themselves generally, as has been shown. As a matter of fact, during the period of the creation of the great literature of Rome, Darwin's law of "reversion" was in active operation. There was a "black sheep" in every noble Roman family. Bad men appeared, not now and then, at long intervals, as in all civilizations, but every day and everywhere; and these men were political and social leaders. They moulded the policy of the State and set the fashion in society. Under their direction the Roman people retrograded towards a state of savagery, and savagery is but another name for selfishness. Selfishness in its worst estate is the essence of human depravity, and to that condition the Roman people fell, at the time when their moralists were inditing those sublime sentiments which still challenge the admiration of all great and good men.

That the Roman people were as dead to the influence of high moral sentiments as the Britons were when first encountered by Cæsar, shows that they had degenerated to a similar condition of savagery, or to a condition of absolute selfishness, which is its moral equivalent. Given a savage state, two savages and one dinner; the savages will fight to the death for the dinner. Given a state of civilization absolutely selfish, two contestants and one prize; each contestant will exhaust all the resources of artifice, duplicity, and falsehood to secure the prize. To this deplorable condition the Roman people were reduced by subjective educational processes. Selfishness causes the individual to seek his own interest in total disregard of the interest of others. Hence it tends directly to the disintegration of society, since the essence of the civil compact is the pledge of each member of the community that he will do no injury to his fellows. Selfishness violates this pledge; for to gain its end it ruthlessly crushes whatever appears in its path.

In Rome selfishness did its complete work. It transformed the government from a pure democracy into an oligarchy composed of wealthy citizens, who called themselves nobles. By this class wealth was made the sole standard of social and political distinction, and in its presence, and through its influence, the old strife between the patricians and the plebeians gave way to a state of hostility between the rich and the poor—always the last analysis of social disorder. The contest was distinguished by assassinations, embezzlements of the public money, the quarrels of rival demagogues, and civil wars, and it culminated in Cæsar and the empire.

The nobles, or aristocrats, who wrought the work of transformation, were refined and elegant in their manners, and accomplished in the tricks of finance, the technicalities of the law, and the arts of oratory. They were the product of the Roman schools of rhetoric and logic, whose subjective methods obscured the truth, promoted vanity, and deified selfishness. All the guards of honor and rectitude having been swept away by Cæsar, a savage contest for supremacy ensued among the aristocrats. The prize for which they contended consisted of the spoil of the Roman legions and the product of the labor of the Roman slaves. This was the Roman patrimony — the price of blood and of the sweat of enforced toil. For this prize the Roman aristocrats struggled like savages fighting for the one dinner.

It is the old struggle, the struggle witnessed by each, in turn, of the nations of antiquity—the struggle in which selfishness vanquishes itself. But this is a struggle of giants, is on a grander scale, and is more conspicuous, for the historian, pen in hand, records its bloody scenes. It is the last act in a great drama, a drama that has lasted a thousand years. It is the conclusion of the long struggle of a few large-brained, unscrupulous individuals, to grasp the fruits of the toil of all men. The conspirators are about to fail, as such conspiracies have always failed and must always fail, and like Samson in his blind fury they will pull down upon their own devoted heads the pillars of the temple. The struggle culminates in a hand-to-hand conflict for the mastery between the baffled chiefs of the conspiracy to enslave mankind—the supreme effort of selfishness—and it involves the authors and their victims in one common disaster. Once more it is proven that a false system of education, a system which exalts abstract ideas and degrades things, promotes selfishness; that selfishness is the equivalent of savagery, and that savagery, however refined, wrecks society.

CHAPTER XXIII.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

THE MIDDLE AGES.

The Trinity upon which Civilization Rests: Justice, the Arts, and Labor; and these Depend upon Scientific Education.—Reason of the Failure of Theodoric and Charlemagne to Reconstruct the Pagan Civilization.—Contempt of Man.—Serfdom.—The Vices of the Time: False Philosophy, an Odious Social Caste, and Ignorance.—The Splendid Career of the Moors in Spain, in Contrast.—Effect upon Spain of the Expulsion of the Moors.—The Repressive Force of Authority and the Atrocious Philosophy of Contempt of Man.—The Rule of Italy—a Menace and a Sneer.—The work of Regeneration.—The Crusades.—The Destruction of Feudalism.—The Invention of Printing.—The Discovery of America.—Investigation.—Discoveries in Science and Art.

Civilization languishes in an atmosphere of injustice, and if the injustice is gross, as slavery, for example, and long continued, the State perishes in the social convulsion which ensues. Thus perished the nations of antiquity. Civilization depends upon the useful arts; in them it had its origin, and with them it advances. The savage, in his most primitive state, is ignorant of all the arts; the most highly civilized man is familiar with, and under obligations to, all of them. The useful arts depend upon labor. If the laborer is degraded, the useful arts decline, as he sinks, in the social scale; if he is honored, they advance, as he rises. The trinity upon which civilization rests is, therefore, justice, the useful arts, and labor; and this trinity of saving forces depends in turn upon the scientific education of man. Rome held all these things in contempt, and Rome perished. Anarchy ensued, and, from a state of governmental chaos, the feudal system was evolved. A brief analysis of the history of the mediæval period will show that education was unscientific, and consequently that justice was scorned, the useful arts neglected, and labor despised.

Theodoric strove to stem the tide of demoralization which succeeded the overthrow of the pagans in Italy. He was a semi-barbarian, but a man of genius, and ten years of his youth, spent at Constantinople, taught him the value of civilization. Under his reign there was a restoration of the common industries, work on internal improvements was resumed, and there was a revival of polite literature and the fine arts. But there was no general prosperity because there was no general system of education. Polite literature must rest upon a basis of general culture, or it is valueless to the country in which it flourishes. So of the fine arts; they can exist legitimately only as the natural outgrowth and embellishment of the useful arts.* In the due order of development the useful precede the fine arts. Theodoric began the reconstruction of the exhausted Roman civilization from the top, and his work was a complete failure,

* "But it is one thing to admit that æsthetic culture is in a high degree conducive to human happiness, and another thing to admit that it is a fundamental requisite to human happiness. However important it may be, it must yield precedence to those kinds of culture which bear more directly upon the duties of life. As before hinted, literature and the fine arts are made possible by those activities which make individual and social life possible; and manifestly that which is made possible must be postponed to that which makes it possible."—"Education," p. 72. By Herbert Spencer. New York: D. Appleton & Co., 1883.

of course, because it had no foundation. It was like the Greek and Roman philosophy, it had no basis of things to rest upon. Hence the order evoked from chaos by the great Ostrogoth to chaos soon returned.

Charlemagne also attempted to reconstruct a worn-out civilization through the revival of polite literature and the fine arts. He assembled at his court distinguished *littérateurs* from all parts of the world, with the view of reviving classical learning. He established a normal school called "The Palatine," whence classically trained teachers were sent into the provinces. He constructed gorgeous palaces, some of which were ornamented with columns and sculptural fragments, the spoil of the earlier architectural triumphs of Italy. But he did not found schools for the education of the common people. The common people were serfs. The theory of Plato still prevailed, namely, that the majority is always dull, and always wrong; that wisdom and virtue reside in the minority. In pursuance of this theory, which happens, curiously enough, to inure to the exclusive benefit of its inventors and supporters, education was confined to a small class. The training of the masses was wholly neglected, and they were poor, ignorant, and brutal. The state of mediæval society is graphically summarized by a modern historian:

"In the castle sits the baron, with his children on his lap, and his wife leaning on his shoulder; the troubadour sings, and the page and the demoiselle exchange a glance of love. The castle is the home of music and chivalry and family affection; the convent is the home of religion and of art. But the people cower in their wooden huts, half starved, half frozen, and wolves sniff at them through the chinks in the walls. The convent prays and the castle sings; the cottage hungers and groans and dies."*

Enterprise was the slave of superstition and ignorance. Some monks in Germany desired to erect a corn-mill, but a neighboring lord objected, declaring that the wind belonged to him. The useful arts were unknown and unstudied except by the monks, and their practice of them was confined chiefly to fashioning utensils for the use of the altar. Mankind lay in a state of intellectual and moral paralysis. Feudalism emasculated human energy. One art only flourished—the art of war. The pursuit of any of the useful arts, beyond that of agriculture, by the serfs, was impracticable, since sufficient time could not be spared from feudal strife for the proper tillage of the soil. The vassal was always subject to summary call to arms. If in the spring the noble wished to fight, the fields remained unplanted; if he wished to fight in the fall, the harvest remained ungathered. The serf, therefore, led a precarious life. If he escaped death in battle, he was still quite likely to die of starvation. In the fertile plains of Lombardy, in the first half of the thirteenth century, there were five famines!

Nothing happens without due cause. The misfortunes suffered by the people of Europe during the Middle Ages did not fall upon them from the clouds. The moral darkness which veiled the face of justice, and the intellectual stupor which prevented scientific and art researches, are not inexplicable mysteries. The vices, the cruelties, the poverty, and the pitiable superstitions of that time were the product of a false phi-

* "The Martyrdom of Man." By Winwood Reade. New York: Charles P. Somerby, 1876.

losophy, an odious social caste, and a state of general ignorance.

It happens that for hundreds of years of this period of wretchedness and crime there was in the heart of Europe an industrious, cultured, prosperous, and happy people. Their religion forbade the taking of usurious interest under terrible moral penalties; it also forbade "all distinctions of caste," and enjoined full social equality. They were the friends of education. "To every mosque was attached a public school, in which the children of the poor were taught to read and write." They established libraries in their chief cities, and were the patrons of the sciences and of the useful arts in all their forms. In a word, to the general prevalence of superstition and ignorance in Europe the Moors in Spain constituted a glowing exception.

Wherever the Saracen went he carried science and art. He honored labor, and genius and learning followed in his footsteps. Taught by learned Jews, he studied the works of the ancient philosophers, and preserved and extended their knowledge of astronomy, chemistry, algebra, and geography. Cordova was the abode of wealth, learning, refinement, and the arts. Its mosques and palaces were models of architectural splendor, and its industries employed 200,000 families. Seville contained 16,000 silk-looms, and employed 130,000 weavers. The banks of the Guadalquivir were thickly studded with those gems of free labor, manufacturing villages. The dyeing of silk and wool fabrics was carried to great perfection, and the Moorish metal-workers were the most expert of the time. The Saracen invented cotton paper, introduced into Spain cotton and leather manufactures, and promoted the cultivation of sugar-cane, rice, and the mulberry. Nor did he neglect agriculture in any of its branches; he created a new era in husbandry. His kingdom in Spain was the richest and most prosperous in the Western world; indeed, its prosperity was in striking contrast with the poverty and misery of the peoples by whom it was surrounded. Under the third caliph its revenue reached £6,000,000 sterling, a sum, as Gibbon remarks, which in the tenth century probably surpassed the united revenues of all the Christian monarchs. But these industrious, cultured people were the descendants of invaders, and the Spaniards, under the influence of a blind and unreasoning impulse of religious and patriotic zeal, drove them from the soil they had literally made to "blossom like the rose," and themselves relapsed into a state of indolence, ignorance, and poverty.

From the effects of the persecution of a race of artificers, and the proscription of the useful arts, Spain has never recovered. She has since always been, and is to-day, a striking exemplification of the verity of the proposition that stagnation in the useful arts is the death of civilization. In the last half of the seventeenth century the people of Madrid were threatened with starvation. To avert the impending calamity the adjacent country was scoured by the military, and the inhabitants compelled to yield supplies. There was danger that the Royal family would go hungry to bed. The tax-gatherer sold houses and furniture, and the inhabitants were forced to fly; the fields were left uncultivated, and multitudes died from want and exposure. During the seventeenth century Madrid lost half its population; the looms of Seville were silenced; the woollen manufactures of Toledo were transferred by the exiled Moriscoes to Tunis; Castile, Segovia, and Burgos lost their manufactures, and their inhabitants were reduced to poverty and despair.*

Two leading causes contributed to reduce the people of Europe during the Middle Ages to a state of moral obliquity, intellectual torpor, and physical incapacity—the repressive force of authority and the atrocious philosophy of contempt of man formulated by Machiavelli. The one forbade scientific investigation, the other strangled the spirit of invention in the grip of enforced ignorance. Authority chilled courage, and contempt withered hope. Italy governed the world, and her rule consisted of a menace and a sneer. Under this *régime* of cruelty and cynicism man shrunk into a state of moral cowardice and intellectual lethargy.

The political maxims which bear the name of Machiavelli were not invented by him. When he formulated them, in 1513, they had been in force in Italy a thousand years. These maxims explain the fact of the existence of a period of the world's history known as "the Dark Ages." The chief of them divides the human race into three classes, the members of the first of which understand things by their own natural powers; the second when they are explained to them; the third not at all. The third class embraces a vast majority of men; the second only a small number; the first a very small number. The first class is to rule both the other classes, the second by craft and duplicity, the third by authority, and, that failing, by force. Other maxims assume the despicable character of all men, and justify falsehood,

* "The Intellectual Development of Europe," Vol. II., Chap. II. By John William Draper, M.D., LL.D. New York: Harper & Brothers; "History of Civilization in England," Vol. II., Chap. I. By Henry Thomas Buckle. New York: D. Appleton & Co., 1864.

duplicity, cruelty, and murder, in the ruling class. A single proposition shows the infamy of the whole system, namely, "There are three ways of deciding any contest —by fraud, by force, or by law, and a wise man will make the most suitable choice."* These are maxims not of civilization but of barbarism. They involve a state of slavery, and where slavery exists the useful arts decline, and ultimately perish. And so it was in the Middle Ages.

Several great events led to the emancipation of the people of Europe from the joint reign of authority and contempt. The learning of the Jews and Saracens—their knowledge of the arts and sciences—gradually spread, and occupied the minds of cloistered students, giving to them an intellectual impulse. The Crusades, pitiful and prolific of horrors as they were, shed a great light upon Europe. They brought the men of the West face to face with a practical progressive civilization—a civilization that "filled the earth with prodigies of human skill." The Crusaders were told that they would be led against hordes of barbarians. What astonishment must have seized them when they stood under the walls of Constantinople and beheld its splendors! Nor was their surprise less, doubtless, in the character of the foe they encountered. They had expected to meet with treachery and cruelty; they found chivalry, courtesy, and high culture.†

These surprises and contrasts profoundly impressed the Crusaders, and they returned to Europe relieved of

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* "The Prince," Chap. XVIII. By Niccolo Machiavelli.

† "The Intellectual Development of Europe," Vol. II., pp. 135, 136. By John William Draper, M.D., LL.D. New York: Harper & Brothers.

many illusions, and notably of the fallacy that the wealth of Eastern princes was destined to supply the waste of their own squandered estates. They returned, too, to find a new civilization in process of development. Two hundred years of comparative freedom from the repressive force of feudalism changed the face of the country and the character of its people. During the absence of the nobles, in the Holy Land, a middle class sprung into existence, possessing the qualities which always distinguish that class—thrift and prudence. The mortgaged estates of the Crusaders had fallen partly into their hands, and partly into the hands of the Crown. Towns had sprung up, and a commercial class and a manufacturing class had been formed. The artisan became a factor in the social problem. He offered his wares to the lords and ladies of the castles, and they bought themselves poor. As Emerson says, "The banker with his seven per cent. drove the earl out of his castle." In the eleventh century nobility was above price, in the thirteenth it was for sale, and soon afterwards it was offered as a gift.

The invention of printing, the art preservative of all arts, removed the seal from the lips of learning. The desire to conceal is no match for the desire to print. Thenceforth, through the medium of types, the voice of genius was destined to reach to the ends of the earth; and, more important still, every discovery in science, and every invention in art, became the sure heritage of future ages.

The discovery of America was the crowning act of man's emancipation. In sweeping away the last vestige of the theory on which patristic geography was based, Columbus freed mankind. In the cry of "land ho!"

with which he greeted the new continent, he sounded the death-knell of intellectual slavery. His was the last act in a series of acts which struck off the shackles of thought, and let in upon the long night of the Middle Ages the clear light of day. Leonardo da Vinci took up the interrupted work of Archimedes, and the science of mechanics made rapid progress. At last it was correctly observed that "experiment is the only interpreter of nature," and the development of natural philosophy began. Bruno was still to be burned, and Galileo imprisoned. But the persecutors of those great men were no longer moved by mere blind zeal. They believed and trembled, and in seeking to drown the truth in the blood of the votaries of science, they rendered it more conspicuous. By the light of the flames which consumed the body of the too daring philosopher a thousand scientists studied the stars, the earth, and the air.

The invention of printing paralyzed authority, and the discovery of America gave wings to hope. A few manuscripts could be locked in vaults or burned, but millions of books must inevitably, ultimately, find their way to the people. Books were, therefore, the sure promise of universal culture—the precursor of the common school. The discovery of another continent startled the people of Europe from the deep sleep of a thousand years, and sent a fresh current of blood surging through their veins. It seemed like a sort of new creation, and appealed powerfully to the imagination. And it is always the imagination that "blazes" the path to glorious achievements. It is through the imagination that men are moved to "crave after the unseen," and through the imagination that the human mind becomes big with "bold and lofty conceptions." A new world having been discovered by one man, it was natural that all men should be put upon inquiry. Hence the era of investigation, the resulting discoveries of science, and their innumerable applications, through the useful arts, to the fast multiplying needs of man.

CHAPTER XXIV.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

EUROPE.

The Standing Army a Legacy of Evil from the Middle Ages.—It is the Controlling Feature of the European Situation.—Its Collateral Evils: Wars and Debts.—The Debts of Europe Represent a Series of Colossal Crimes against the People; with the Armies and Navies they Absorb the Bulk of the Annual Revenue.—The People Fleeing from them.—They Threaten Bankruptcy; they Prevent Education.—Germany, the best-educated Nation in Europe, losing most by Emigration.—Her People will not Endure the Standing Army.—The Folly of the European International Policy of Hate. —It is Possible for Europe to Restore to Productive Employments 3,000,000 of men, to place at the Disposal of her Educators $700,000,000, instead of $70,000,000 per annum, and to pay her National Debts in Fifty-four Years, simply by the Disbandment of her Armies and Navies.—The Armament of Europe Stands in the Way of Universal Education and of Universal Industrial Prosperity.—Standing Armies the Last Analysis of Selfishness; they are Coeval with the Revival during the Middle Ages of the Greco-Roman Subjective Methods of Education.—They must go out when the New Education comes in.

THE mediæval period conferred upon man two great blessings—a new continent and the art of printing. It also left a legacy of evil. With the partition of Europe into great States the modern age began, and it began with this inheritance of evil from the Middle Ages—the standing army.

The feudal lords wrecked their estates and sacrificed their lives during the Crusades, and a middle class arose and united with the kings in the government of the

State. But this alliance was of short duration; it soon gave way to an alliance which proved to be enduring—an alliance between the aristocracy and the kings.

By the ruin of feudalism thousands of serfs were set free. Trained to arms, it was easy to make soldiers of them. They were accordingly converted into mercenary troops—mustered into the service of the new alliance as guards of the modern State. Thus the standing armies of the "great powers" originated. This legacy of evil has so increased in magnitude that it is, to-day, the dominant feature of European public economy, and the portentous fact of the social problem.

The standing armies of Europe number two million five hundred thousand men, and their naval auxiliaries consist of three thousand vessels, thirty thousand guns, and two hundred thousand men. This is the mammoth evil bequeathed to Europe by the Middle Ages, and out of it many collateral evils have sprung, as wars, debts, and exorbitant tax levies.

Thirty years ago the national debts of the governments of Europe had risen to $9,000,000,000. Since that time they have doubled! The cause of this vast increase is easy to find. It consists chiefly of four great wars, namely, the Crimean war of 1854–56, the Franco-Sardinian war against Austria in 1859, the German-Italian war of 1866, and the Franco-Prussian war of 1870–72. These wars were waged to maintain what is termed the balance of power; they involved no principle affecting the rights of man. Whatever their issue, no gain could hence accrue to the people of Europe. And this is the nature of most of the wars in which the standing armies of Europe have been employed since their organization. But the European budget shows that they are the over-shadowing feature of the European governmental systems.

The annual revenue of the States of Europe is about $1,725,000,000. Of this sum $700,000,000 is devoted to the support of the standing armies and navies, and as much more is required to meet the interest charge on the debts created in the prosecution of wars waged to maintain the balance of power! Thus, of the aggregate of European revenue, the sum of $1,400,000,000 is devoted to the purely supposititious theory that the subjects of the great powers are inflamed with an intense desire to cut one another's throats, while the small sum of $325,000,000 is left for the support of the civil service, comprising all the strictly legitimate objects of government, and including education!

The national debts of Europe represent a series of colossal crimes against the people. They were incurred in the prosecution of unnecessary wars, and for the support of unnecessary standing armies. With relation to these debts the people are divided into two classes—one class owns them and the other class pays interest on them. This relationship comprehends future generations in perpetuity. Every child born in Europe inherits either an estate in these debts or an obligation to contribute towards the payment of the interest upon them. Thus the fruits of a great crime have been transmuted into a vested right in one class of people, and into a vested wrong in another class.*

* "For instance, I have seven thousand pounds in what we call the Funds or Founded things; but I am not comfortable about the founding of them. All that I can see of them is a square bit of paper, with some ugly printing on it, and all that I know of them is that this bit of paper gives me the right to tax you every year, and

If the European standing armies and navies had not been raised and kept up, and if the revenue devoted to their support had been expended for schools, there would not now be an uneducated person in Europe. If these standing armies and navies were now disbanded, and the revenue at present expended for their support diverted to the support of schools, and so applied continuously for half a century, there would not be, at the end of that period, an illiterate person in Europe.

Under existing conditions the debts of the European nations cannot be paid. But vast as the sum of them is, their payment is not only possible, but practicable in a very short time. Disband the standing armies and navies, and continue the present rate of taxation, and there would be an annual surplus revenue of $700,000,000. Apply this sum, together with the surplus of the interest appropriation, accruing through the resulting yearly decrease of the interest charge, to the liquidation of these debts, and they would be extinguished in about twenty years. But if the period during which provision is made for the extinguishment of these debts be extended to fifty-four years, and, meantime, the present rate of taxation be maintained, there would be released and rendered avail-

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make you pay me two hundred pounds out of your wages; which is very pleasant for me; but how long will you be pleased to do so? Suppose it should occur to you, any summer's day, that you had better not? Where would my seven thousand pounds be? In fact, where are they now? We call ourselves a rich people; but you see this seven thousand pounds of mine has no real existence—it only means that you, the workers, are poorer by two hundred pounds a year than you would be if I hadn't got it. And this is surely a very odd kind of money for a country to boast of."—"Fors Clavigera," Part I., p. 67. By John Ruskin, LL.D. New York: John Wiley & Sons, 1880.

able for educational purposes, annually, the sum of $600,000,000.

What is the purpose, it may be inquired, of these calculations? Their purpose is to show what the armies and navies of Europe cost, and what they stand in the way of. They cost so much that not a dollar of the national debts of Europe can be paid while they continue to exist. They cost so much that the people who are taxed to support them are fleeing from them as from a scourge. They cost so much that the decline of the nations which support them has already begun, and this decline can be arrested only by their disbandment.

That the nations of Europe are declining is shown by the statistics of emigration. The foundation of national prosperity is manual labor. There must be a solid basis of industrial growth for the superstructure of elegance, refinement, luxury, and culture. Manual labor is as essential to triumphs in literature, music, and the fine arts as the foundations of the Brooklyn Bridge, buried in the earth, are to the beautiful arch which spans the great river. And in the strife for supremacy between the nations of the world the maintenance of these triumphs depends, also, upon manual labor.* The real flower of a

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* "Now, therefore, see briefly what it all comes to. First, you spend eighty millions of money in fireworks [war], doing no end of damage in letting them off.

"Then you borrow money to pay the firework-maker's bill, from any gain-loving persons who have got it.

"And then, dressing your bailiff's men in new red coats and cocked hats, you send them drumming and trumpeting into the fields, to take the peasants by the throat, and make them pay the interest on what you have borrowed, and the expense of the cocked hats besides.

"That is 'financiering,' my friends, as the mob of the money-makers understand it. And they understand it well. For that is population is, therefore, its labor class. All other classes depend upon it, and all national triumphs spring from it. Hence a drain upon the labor class of a nation is a drain upon its most vital resource. The nation that suffers such a drain continuously is in its decadence. It loses some of its vigor, some of its productive power, and the loss is not supplied. True, the poor emigrant takes with him no part of the splendors of the country he leaves, but his brawny arm and skilled hand have contributed to the support of national pomp and social elegance, and as he steps aboard the steamer he withdraws that support forever.

Napoleon the Infamous plundered the conquered capitals of Europe to beautify and enrich the art treasuries of Paris. The art treasures of Europe are destined to cross the ocean, in the track of the column of emigration, if the flower of her labor class continues to flee from her standing armies and navies, as the statues of Rome followed the army of the modern Cæsar. For where the flower of the world's labor class gathers, there wealth most abounds. Labor, not gold and silver, not land, is the source of wealth, hence it is to the laborer that art triumphs are due, and this is the order of their development. The laborer provides for immediate, pressing wants; he is prudent, and accumulates a surplus; he hungers for education; he develops a love of the beauti-

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what it always comes to, finally—taking the peasant by the throat. He *must* pay—for he only *can*. Food can only be got out of the ground, and all these devices of soldiership, and law, and arithmetic, are but ways of getting at last down to him, the furrow-driver, and snatching the roots from him as he digs."—"Fors Clavigera," Part II., p. 27. By John Ruskin, LL.D. New York: John Wiley & Sons, 1882.

ful; he seeks to dignify his life and adorn his home; he patronizes art; he draws to himself the art treasures of the world.

The standing armies and navies of Europe have cost the European laborer the sacrifice of all these pleasing and noble aspirations. Beyond the point of providing for "immediate pressing wants" he has not been able to pass. His surplus goes to the tax-gatherer, to feed and clothe the army and the navy. His desire for education, his love of the beautiful, his hope of a dignified life, and of a home adorned by art — these all are dreams, illusions, which vanish into thin air in the presence of the substantial fact of the annual European budget—for the support of the standing armies and navies $700,000,000!

In the way of the payment of the national debts of Europe her standing armies and navies rear themselves like an impassable wall. Against any general educational system they have hitherto constituted an insurmountable barrier; and in the future, as in the past, their maintenance dooms the masses to illiteracy. They stand in the way especially of the incorporation, in the curriculum of the public schools, of the manual element in education, because it is the most expensive, as it is the most important part of instruction.

Germany affords an admirable example of the power of education, even though defective in character, and of the disgust with which standing armies inspire an intelligent people. The Germans are the best-educated people in Europe. The educational system of Germany was established by Prussia as a politico-economic measure after the humiliation of the German States by Bonaparte. Said Frederick William, "Though territory, power, and prestige be lost, they can be regained by acquiring intellectual and moral power." The outcome of the Franco-Prussian war of 1870 verified the truth of this prediction. Her freedom from debt enabled Prussia to inaugurate and carry forward a comprehensive educational system, which in turn enabled her not only to vanquish her ancient enemy, but to make France pay the cost of her own humiliation. Thus at a single stroke Prussia avenged the defeats suffered at the hands of the first Napoleon, and permanently weakened France by compelling her vastly to increase her national debt.

The alacrity with which the French people subscribed for the new bonds was much remarked upon, at the time, as evincing both financial soundness and patriotism. But the really grave feature of the situation—the vast augmentation of the public burdens of France—was scarcely mentioned, and was, perhaps, philosophically considered only by that astute statesman, Prince Bismarck. The war with Germany cost France $2,000,000,000, and compelled an enormous increase of taxation. The debt statement for 1877 was $4,635,000,000—the expenditures $533,000,000; and of this latter sum $373,000,000 were absorbed by the army, the navy, and the national debt!

The significant feature of the European situation is the freedom from debt of Germany. It is by virtue of this fact that she holds the first place in Europe. Her rate of taxation is as low as that of little Switzerland. All the other Great Powers are hampered by great debts. Spain is bankrupt; she does not pay the interest on her debt. Austria increases her debt every year; she is practically bankrupt. It is only a question of time, if standing armies and navies continue to be maintained and wars to occur, when all the debtor nations will be reduced to bankruptcy.* The nation sinks as the column of debt rises. France cannot double her debt again and make her people pay interest on it. England draws from her people a larger *per capita* revenue than any other nation of Europe, and she has nearly touched the limit of their capacity to pay taxes. A sudden and considerable increase of her debt would strain the Government, and might shatter it.

Thus, the more searching the analysis of the European situation, the more clear does the exceptional strength of Germany appear. But out of her abundant strength a weakness has been evolved. The system of education that rendered the Germans so powerful against France as soldiers, has made them thoughtful citizens. It has revolutionized the public sentiment of Germany on the subject of government. In the place of passion it has substituted reason. The Prussian "subject" for whom the king thought, has become a German citizen who thinks for himself, and one of his earliest reflections is that, in modern civilization, a standing army is a solecism. The ignorant Prussian hated the French because hatred of them was enjoined upon him as the correlative of the duty of blind devotion to his king. But the educated German knows that the sole motive of the continuance of the standing army is the maintenance of the balance of power, which is merely a tacit agreement between the European rulers, by divine right, to perpetuate their own lease of power. Hence the "in-

* "The progress of the enormous debts which at present oppress, and will in the long run probably ruin, all the great Nations of Europe, has been pretty uniform."—"Wealth of Nations," Vol. III., p. 392. By Adam Smith, LL.D., F.R.S. Edinburgh, 1819.

tellectual and moral power" conferred upon the German people, by education, reacts upon Germany in the form of a drain of the flower of her population by emigration.

The citizenship of Germany is more valuable, in an economic sense, than that of any other country of Europe—more valuable because Germany is the most powerful nation of the European family of States; more valuable because of them all she alone is free from debt; more valuable by reason of her more moderate scale of taxation. But she still furnishes the heaviest contingent to the columns of emigration steadily moving towards the United States. In a word, the most valuable citizenship in Europe—that of Germany—is least regarded and most freely surrendered. Why? Because the Germans are the best-educated people in Europe. Poor as the German primary school system is, it is universal, and it has destroyed what it was founded chiefly to promote and perpetuate, namely, reverence for, and loyalty to, government by Divine right. German intelligence revolts from taxation for the support of a standing army. It revolts from the theory and policy of hate upon which standing armies are based. It comprehends perfectly that the standing army is a menace to the freedom of the citizen, at home, rather than a defence against pretended danger from abroad. It scorns, as absurd, the threadbare assumption that Englishmen, Frenchmen, Italians, Russians, and Germans desire to fly at one another's throats, and that they can be restrained only by a cordon of bayonets. It realizes that the perpetuation of the era of hate, through the standing army, retards the mental and physical progress of the human race, which would be greatly promoted by the free intermingling of the various nationalities of Europe.* That it is from the standing army that the emigrant flees is shown by the records of the military department of the German government.

In the year 1883 twenty-nine thousand men were arrested for attempting to emigrate from Germany to avoid the required military service, and more than a hundred thousand others, from whom service was due, refused, both to report for duty, and to furnish the required excuses for the failure to enroll themselves.

The law of Germany requires every male citizen, capable of bearing arms, to serve three years in the standing army—to devote three of the best years of his life to the preservation of the balance of power in Europe! In addition, he must serve four years in the reserve, and five years in the landwehr. And this service is regarded as a debt due the government. Every male child born in Germany contracts this debt, in contemplation of law, in the act of drawing his first breath, and nothing but death releases him from the obligation. Having been taught in the emperor's schools to love the emperor, when he reaches the military age, a musket is placed in his hands,

* The multiplicity of languages is due to the policy of international hate, inaugurated by the nations of Europe to promote the selfish purposes of rulers. Barbarism is diversity; civilization is unity. The human race is one, provided it is civilized, and it should have but one language. Language is a tool, and time consumed in acquiring skill in the use of more than one tool designed for the same end, is wasted. The standing armies of Europe obstruct the way to unity of language. The time will come when all civilized peoples will speak one tongue. Then language will cease to be a mere vain accomplishment, and become what it ought always to have been, the simple means of familiarizing the mind with things, and of the communication of knowledge.

and he is taught to shoot the emperor's enemies. If he refuses to enter the army he is fined; if he refuses to pay the fine he is imprisoned.

The German emperor attributes the decline in the military organization to the negligence of his military staff, but its true cause is the German educational system. The steady augmentation of the rolls of military delinquents is the measure of the growth of German intelligence. The ease with which Germany conquered France flattered the vanity of the educated German, but it did not prevent him from emigrating to America. To the cultured mind the army that wins the contest in which no principle is involved is as odious as the army that loses. To the cultured mind all standing armies are odious, because they are an embodied assumption of the barbarism of man, and a denial of the efficacy of reason. The great stream of German emigration attests the superiority of German culture. The educated German declines to learn the art of shooting the emperor's enemies, but he knows that Germany is, in fact, governed by its standing army—by muskets—and he quits the country.

Thus the chief power of Germany becomes her chief weakness. A system of education which has made her the first nation in Europe produces wide-spread discontent among her people, because she is governed by obsolete ideas. Nor can the loss in virile force suffered by Germany, through emigration, be made good by a counter movement of immigrants from the less favored countries of Europe. The economic condition of Germany—her freedom from debt and her comparatively low rate of taxation—invite such a movement. But the European policy of international hate, created and perpetuated by standing armies, forbids Germany to recoup her losses of men to America, through corresponding gains of men from the overtaxed populations of neighboring countries. The grinning skeletons of a hundred battles in which the rival nationalities of Europe have been pitted against one another, rise to challenge the social intermingling of peoples separated for centuries by the arts of diplomacy, traditions of blood and flames, and the serried ranks of standing armies.

The disposition of Germans to emigrate irritates the emperor and his prime-minister. The loss of numbers might be borne, for notwithstanding the steady outward flow of emigrants there is a slight increase of population in Germany. But it is the quality of the exodus that annoys the emperor and his chancellor. The German emigrants are strong men and women—strong mentally and physically. All the weaklings, all the paupers, all the imbeciles, the aged, and the infirm remain, only the young and vigorous go. Those who go have been taught at the expense of the State to love the emperor and hate his enemies, but they do neither. The German system of education, from the point of view of rulers by divine right, is, hence, a conspicuous failure. It makes better men but poorer subjects. The more thoroughly the man is educated the more valuable he is to himself and to the community, but the less valuable to his king. His growth in intelligence is the measure of his decline in reverence for rulers by divine right, and the standing armies by which they are alone supported. This is the cause of German emigration, and its effect is to weaken the German Empire. Germany is not so strong as she was when her armies swept over France; she declines in power each year, through the loss of men—the sole support of a State. They flee from her standing army to the United States, a republic with only a handful of soldiers.

The system of education established to increase the power of Prussia in Europe has accomplished its purpose. But it has done much more — something never thought of by its founders. It has produced a widespread feeling of intelligent discontent; and discontent is an inarticulate cry for reform. The cultured German scorns the standing army, refuses to serve in it, protests against its longer existence, and demands more and better education for his children. His protest is unheeded, and he quits the country. But the demand for higher education is not, cannot be, disregarded. Intelligence is contagious; it infects with a thirst for knowledge all with whom it comes in contact. Education is the arch-revolutionist whose onward march is irresistible. Soon a riper culture will make the German Protestants more courageous and more imperative in their demands, and they will remain in the country to enforce them. Education made Germany the first military power in Europe; but education could not have been put to a more ignoble service. The desire of intelligent Germans is that Germany shall become the first industrial power in Europe, and this desire can be realized by the disbandment of her standing army.

This review of the situation in Europe shows that it is practicable for her to restore, at once, to productive employments three millions of men — the flower of her population—now not only idle, but a public charge. It shows, also, that it is practicable for Europe to place, at once, at the disposal of her educators $700,000,000 per annum instead of $70,000,000 per annum, as at present. The corollary of these two propositions is a third, namely, that it is practicable for Europe to extinguish her national debts in fifty-four years. It follows that the regular armies of Europe alone stand in the way of universal education, and of universal industrial prosperity.

Standing armies everywhere within the lines of advanced civilization must soon disappear before the march of education.* Social questions cannot much longer be settled by emigration. The world's virgin soil is being rapidly appropriated. When the surface of the whole earth shall have become occupied, barbarisms of every nature will be intolerable. Man must then be highly civilized, and the only highly civilizing influence is education. The age of force is passing away; the age of science and art—the age of industrial development—has begun, and standing armies are as abnormal in Europe

* "This nation to-day is in profound peace with the world; but in my judgment it has before it a great duty, which will not only make that profound peace permanent, but shall set such an example as will absolutely abolish war on this continent, and by a great example and a lofty moral precedent shall ultimately abolish it in other continents. I am justified in saying that every one of the seventeen independent Powers of North and South America is not only willing but ready—is not only ready but eager—to enter into a solemn compact in a congress that may be called in the name of peace, to agree that if, unhappily, differences shall arise — as differences will arise between men and nations—they shall be settled upon the peaceful and Christian basis of arbitration.

"And, as I have often said before, I am glad to repeat, in this great centre of civilization and power, that in my judgment no national spectacle, no international spectacle, no continental spectacle, could be more grand than that the republics of the Western world should meet together and solemnly agree that neither the soil of North nor that of South America shall be hereafter stained by brothers' blood." —Extract from the Speech of Hon. James G. Blaine at the Delmonico Dinner, October 29, 1884.

now as slavery was in the United States twenty-five years ago.*

Standing armies are the instruments of tyranny; they are the last analysis of selfishness, the incarnation of depravity; for they do not reason — they strike. It is worthy of note that the standing armies of Europe are coeval with the revival of learning, and the revival of learning was a revival of the Greco-Roman subjective educational methods. The logical effect of those methods was the promotion of selfishness, and the standing armies conserved the selfish designs of the rulers of the newly-formed States. It is hence not a mere coincidence that standing armies and the revival of learning through subjective processes of thought are of common origin. The Machiavellian philosophy of cruelty, duplicity, and contempt of man sprung logically from egoism, and as logically led to the formation of standing armies—bodies of armed men, trained, under compulsion, to kill, burn, and destroy.

The synonyms of the standing army are selfishness and its vile issue, feudalism, serfdom, slavery, ignorance, and contempt of man. These conditions are passing away, and the standing army, the worst, as it is the most costly relic of savagery, must pass away with them. It cannot withstand the advance of the new education, whose mission is peace, whose quest is the truth, whose premise is a fact, whose conclusion is a thing of use and beauty, and whose goal is justice.

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* "It is only slowly, and after having been long in contact with society, that man becomes more indulgent towards others and more severe towards himself."—"Suicide: an Essay on Comparative Moral Statistics," p. 226. By Henry Morselli, M.D. New York: D. Appleton & Co., 1882.

CHAPTER XXV.

EDUCATION AND THE SOCIAL PROBLEM—HISTORIC.

AMERICA.

An Old Civilization in a New Country.—Old Methods in a New System of Schools.—Sordid Views of Education.—The highest Aim Money-getting.—Herbert Spencer on the English Schools.—Same Defects in the American Schools.—Maxims of Selfishness.—The Cultivation of Avarice.—Political Incongruities.—Negroes escaping from Slavery called Fugitives from Justice.—The Results of Subjective Educational Processes.—Climatic Influences alone saved America from becoming a Slave Empire.—Illiteracy.—Abnormal Growth of Cities.—Failure of Justice.—Defects of Education shown in Reckless and Corrupt Legislation.—Waste of an Empire of Public Land.—Henry D. Lloyd's History of Congressional Land Grants.—The Growth and Power of Corporations.—The Origin of large Fortunes, Speculations.—Old Social Forces producing old Social Evils. — Still America is the Hope of the World. — The Right of Suffrage in the United States justifies the Sentiment of Patriotism.—Let Suffrage be made Intelligent and Virtuous, and all Social Evils will yield to it; and all the Wealth of the Country is subject to the Draft of the Ballot for Education.—The Hope of Social Reform depends upon a complete Educational Revolution.

The discovery of America startled Europe. It was a great blow to prevailing dogmatisms. It upset many learned (?) theories. It swept away patristic geography. It completed the figure of the earth, rendering it susceptible of intelligent study. The advantages of such investigation accrued to man, to a degree, before the social and civil life of America began. In the century and a quarter which elapsed between the landing of Columbus and that of the Pilgrims, on these shores, considerable social and political progress was made in Europe, and especially in England. From the turbulent scenes of the reigns of James I. and Charles I., which eventuated in the Cromwellian rebellion and victory of the Commons, the Pilgrims escaped. They not only bore with them, to the new continent, the impress of the long struggle for liberty waged by the English people, but they were, in a certain sense, the product of the progress of all the ages. But they constituted only a small part of the column of immigrants. Detachments of the Cavaliers came also, and Germans, Frenchmen, and Irishmen came with them.

The discovery of America was a sort of new creation,* but its almost virgin soil was destined to become the home of an old civilization. From all the nationalities of the Old World the New World was to be peopled. The ambitious, the restless, the adventurous, the enterprising, and the hardy of every tongue, were gradually to assemble in the new field of action. The manner in which they treated the natives of the new country, both north and south, showed their origin and their training. Their determination to conquer and hold the new territory was but thinly disguised. Their descent upon the Atlantic coast was not the exact counterpart of that of Cæsar upon the coast of Britain, but it was the same in spirit; and the active trade in slaves which soon sprang up, and which was thereafter vigorously prosecuted for two hundred years, showed the taint of savagery—the impress of Roman cruelty, rapacity, and injustice.

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* "The discovery of America is the greatest event which has ever taken place in this world of ours, one half of which had hitherto been unknown to the other. All that until now appeared extraordinary seems to disappear before this sort of new creation."—Voltaire.

It is evident that in its most important feature—the formation of character—education had made little if any progress at the time of the organization of civil society in America. The democratic idea was not new. It found expression in every form during the struggles of Greece and Rome, and the revival of learning had led to the discussion of governmental questions in the light of history. Besides, the reformation of Luther had opened the way to the last analysis of dissent in the person of Roger Williams, who asserted the right of absolute freedom of thought and speech. Of the religious right of private judgment the political right of an equal voice in public affairs is the corollary. Hence, that the Puritans should establish the town organizations so justly lauded by M. Tocqueville was quite logical.* Nor was the public-school system less logical; all citizens being members of the government, all children must be prepared for the duties of citizenship. But unfortunately the old system of education was put into the new schools, as the old civilizations had been transferred to the new country. The system of education under which the kings and ruling classes of England and of the continent of Europe were trained to selfishness, cruelty, and injustice, was heedlessly adopted in the schools of New England, which became the models of schools throughout the country.

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* "Town meetings are to liberty what primary schools are to science; they bring it within the people's reach, they teach men how to use and how to enjoy it. . . . The township institutions of New England form a complete and regular whole; they are old; they have the support of the laws, and the still stronger support of the manners of the community, over which they exercise a prodigious influence." —"Democracy in America," Vol. I., p. 76. By Alexis De Tocqueville. Boston: John Allyn, 1876.

The popular idea in regard to the schools was (1) that they fitted their pupils for the duties of citizenship, or, more properly, for the art of governing, and (2) that they taught the art of getting on in the world; and getting on in the world was interpreted to mean getting and keeping money. That this sordid view of education was generally held in the rural districts of New England is shown by the fact that any culture beyond a limited and imperfect knowledge of reading, writing, and arithmetic was regarded as superfluous. Not even the rudiments of either the sciences or the arts were imparted, and yet it is only through a knowledge of the sciences and the arts that progress in civilization is made. The early settlers of New England devised a new system of schools, but they imported into them an old system of education, the Greco-Roman subjective system, introduced into England with the revival of learning. Of this system Mr. Herbert Spencer says, "Had there been no teaching but such as is given in our public schools, England would now be what it was in feudal times." And he adds:

"The vital knowledge, that by which we have grown as a nation to what we are, and which now underlies our whole existence, is a knowledge that has got itself taught in nooks and corners, while the ordained agencies for teaching have been mumbling little else but dead formulas."*

But these are merely negative effects of subjective methods of education. The positive evil effect of them

* "That which our school courses leave almost entirely out, we thus find to be that which most nearly concerns the business of life. All our industries would cease were it not for that information which men begin to acquire as they best may after their education is said to be finished."—"Education," p. 54. By Herbert Spencer. New York: D. Appleton & Co., 1883.

is selfishness, the sum of all villanies. Under the new system of schools—schools for all—the old philosophy of life flourished. Under the name of prudence, selfishness was deified. The maxim of Herbert—"Help thyself and God will help thee"—was reproduced by Franklin in a hundred forms. The child was taught, not that "The half is more than the whole," but that "In the race of life the devil takes the hindmost."

Thus greed and avarice were cultivated to the sacrifice of honesty. Calling selfishness prudence led to confounding right and wrong—freedom and slavery. Hence we have the Declaration of Independence containing the lofty sentiment, "All men are created equal," and the Constitution throwing the shield of its protection over human bondage. A false system of education led to political incongruities of the grossest character, as, in the preamble to the Constitution, the declaration of its high purpose—to establish justice and secure the blessings of liberty—and in the body of the instrument a guaranty of the slave-trade for twenty-five years, and a compact that it should be the duty of the national army to shoot rebellious slaves, and the duty of free citizens, of the free States, to hunt down escaping slaves and surrender them to their owners in the slave States.

The failure of the prevailing system of education to promote rectitude and right thinking was so complete that negroes escaping from slavery were called "fugitives from justice!" Its failure was so complete that the very streets of Boston in which patriots had struggled to the death in the cause of liberty now echoed the groans of the slave, and resounded with the clank of his chains. Its failure was so complete that in Faneuil Hall, the cradle of liberty, slavery was justified. Its failure was so complete that a senator, for daring to characterize slavery as barbaric, was stricken down and beaten with a club, until he lay helpless in a pool of blood on the floor of the legislative hall of the great, free republic.

These are characteristics of the early civilizations, the civilizations of Greece and Rome. They are the product of selfishness, and they show that subjective educational processes—processes which proceed from the abstract to the concrete, thus violating the natural law of investigation—produce the same effects in the nineteenth century as they did in the first century.

Ethically, slavery was tried only by the test of self-interest. In the North, as in Europe, it was not profitable, and it faded away; in the South, in the cotton and rice fields, it was thought to be profitable, and it spread and flourished. That the opposition to slavery, at the North, did not grow out of education in the schools, is evident, because the sons of the Southern ruling class were educated in the high schools and colleges of the North; but they became, notwithstanding such training, almost to a man, slavery propagandists. The heinousness of slavery was perceptible only to those who had no personal interest in its perpetuation. It is plain that the effect of the education of the schools upon the youth of the country was to make them callous to the common impressions of right and wrong; in a word, to render them thoroughly selfish.

It is difficult to resist the conclusion that, if slavery had been as profitable at the North as it was at the South, it would have been perpetuated, and would have poisoned the infant civilization of America as that of Rome was vitiated and destroyed. Assuming the truth of this hypothesis, climate conditions, not education, saved this continent from the scourge of slavery. To the fact that a large part of the territory of the United States is situated in the temperate zone we owe the elimination of slavery from the social problem.

Existing social conditions in the United States do not differ materially from those of the chief countries of Europe. We have only a small standing army; but the sole great question which divided the people during the first hundred years of our political existence — slavery—had to be settled as such questions have been settled from the beginning of history, as savages settle all questions — by violence, by an appeal to the logic of brute force.

Our government differs from the governments of Europe both in principle and form, but the governmental influence is only one of many influences which unite to mould social habits. The democratic principle, adopted as the foundation of our political institutions, has not served to counteract the tendency to the formation of social class distinctions. The people lack the wisdom, or the virtue, or both, to insist upon the first prerequisite to even an approximation to social equality, namely, universal education. Of our population of fifty millions, five millions of persons, ten years old and over, are unable to read, and six millions are unable to write. In the last census decade we made the paltry gain of three per cent. in intelligence, but in 1880 we had six hundred thousand more illiterates than in 1870. Nearly two millions of the legal voters in the United States are illiterates. Every sixth man who offers his ballot at the polls is unable to write his name. Under such circumstances class distinctions of the most pronounced type are inevitable.

The tendency to the concentration of populations in cities in the United States is not less decided than it is in the countries of Europe. In 1820 the population of our cities constituted less than one-twentieth of the whole population of the country, but in 1880 it constituted more than one-fifth of the whole.

Cities have always been the chief source of societary disturbances. In the worst days of the Roman Empire tranquillity and prosperity reigned in many of the distant provinces. While at the city of Rome "every kind of vice paraded itself with revolting cynicism," in the provinces "there was a middle class in which good-nature, conjugal fidelity, probity, and the domestic virtues were generally practised."

Of one of the youngest large cities in the United States the superintendent of a Training School for Waifs says, "Never in the history of this city has infant wretchedness stalked forth in such multiplied and such humiliating forms. It is hard to suppress the conviction that even Pagan Rome, in the corrupt age of Augustus, did not witness a more rapid and frightful declension in morals than that which can to-day be found in the city of Chicago."

The most graphic description ever given of a waif came from the lips of John Morrissey.* He said of himself,

"I was, at the age of seven years, thrown a waif upon the streets of Dublin. I slept in alleys and under sidewalks. I disputed with other waifs the possession of a crust. We fought like young savages for the garbage that fell from the basket of the scullion. The strongest

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* A noted pugilist, proprietor of gambling-houses in New York City and at Saratoga Springs, and a politician who represented a New York City district in Congress.

won and satisfied the cravings of hunger; the weakest starved. I had no idea that anything was to be gained by other means than brute force. Hence my code of moral and political ethics—the strongest man is the best man. I became a pugilist."

The substantial citizen who passes the street waif with contempt should reflect that ten or a dozen years later he will meet him, a full-grown man, at the polls, still clothed in rags, perhaps, but his peer in all the rights of citizenship. It was the unfortunates of the dark alleys and noxious streets of New York—the waifs, the savages of the John Morrissey type—that made Tweedism* possible, that made robbery in the name of law possible, that made taxation the equivalent of confiscation in that city.

Mr. Charles Dickens, in "Bleak House," in the course of a pen-picture of a wretched quarter of London, under the name of "Tom-all-alones," shows how ignorance, poverty, and vice react upon society. He says, "There is not an atom of Tom's slime, not a cubic inch of any pestilential gas in which he lives, not one obscenity or degradation about him, not an ignorance, not a wickedness, not a brutality of his committing but shall work its retribution through every order of society, up to the proudest of the proud, and to the highest of the high."

The presence of the poison is already shown in the failure of justice. These waifs, grown to man's estate, but destitute of education and moral principle, wielding the power of the ballot, desecrate the jury-room with their vile presence, and tug at the skirts of sheriffs,

* For an account of the career of William Marcy Tweed, see "The American Cyclopædia," Vol. XVI., p. 85. New York: D. Appleton & Co., 1881.

prosecuting officers, and judges, and notorious criminals escape punishment! So grievous has the abuse become that Judge Lynch has opened his summary, awful court in almost every State of the Union.

To say that this class menaces the government with destruction is to state it mildly. In every case of the failure of justice the government is in part subverted; for when crime goes unpunished, the law, violated in that particular instance, becomes a dead letter; and when lynching shall have become the rule, and the execution of the law the exception, government by law will have ceased to exist — it will have given way to government by force. Then the army will be invoked to shoot down the men for whose education the law failed to provide, in every city of the land, as it was invoked in Pittsburg in 1877.

What are we doing to avert this danger which threatens our institutions? With the exception of here and there a weak effort on the part of a few humanitarians, as in the training school referred to, we are leaving hundreds of thousands of waifs to develop into savages, and, what is worse, savages with the power to tax civilized people! We have a system of public schools into which such children as choose may enter to a certain limit, remain as long as they please, and depart when they please. But there are thousands of children in every large city who could not enter if they would, and who are not compelled to receive the civilizing benefits of education, and who hence join the army of waifs and study the art of savagery; and, as has been remarked, they go to swell the ranks of a populace as depraved as that which in Rome cried for "bread and circuses!" and sacked the city while it was in flames.

The defective, not to say vicious character of our system of education, is shown by the reckless course of our legislators on the subject of the disposition of the public domain. William the Conqueror, conceiving that any social revolution is incomplete until it disturbs the proprietorship of land, confiscated the entire landed estates of England, and conferred what remained of the proprietary, after reservations in the Crown, upon his retainers, the Normans. Eight hundred years have elapsed since the issue of William's land-tenure edict, but it still remains the controlling feature of the British Constitution. It has compelled the deportation of millions of Englishmen; it has reduced the masses of Scotland to a grinding poverty, and converted their country into hunting-grounds for the amusement of the landlord class; it has depopulated Ireland, and exasperated almost to madness the remnant of her people.

But we have failed to profit by the example of England. Our legislators have been blind to the lessons of history, or they have been corrupt. They have been ignorant of political and social laws, or they have been wanting in rectitude. In the period of thirty years, ended in 1880, Congress gave to railway corporations over 240,000 square miles, or 154,067,553 acres, of the best public lands in the States and Territories of the Union — an area double that of the whole kingdom of Great Britain and Ireland, including the adjacent isles.

On the 17th of March, 1883, the *Chicago Daily Tribune* published a history of these land grants, compiled by Mr. Henry D. Lloyd, under the following summary:

"*The story of the dissipation of our great national inheritance — thrown away by Congress, wasted by the Land Office, stolen by thieves. A land monopoly worse* *than that of England, begotten in America. English monopoly is in families; American monopoly is in corporations; and corporations are the only aristocrats that have no souls, and never die.*"

The following passages from the opening paragraphs of Mr. Lloyd's history are reproduced here by permission of the author:

"The public are profoundly ignorant of the facts about the public land. They know, in a dim way, that it is passing out of their hands, and that huge monopolies are being created out of the lands which they meant should be the inheritance of the settler. The land set apart for homes for families has been made into empires for corporations. In the story recited below, every element of human fault and fraud will be seen to have been at work in the spoliation of the land of the people. Congress has been extravagant and has failed to act when part of the results of its extravagance might have been saved. The Land Office has been inadequately equipped by Congress, and has on its own account been careless, dishonest, and traitorous to the interests of the people. It has been wax in the hands of the great railroad corporations, but double-edged steel in the side of the poor settler. It has overruled decisions of the Supreme Court and nullified acts of Congress to betray its trust and enrich the railroads, but has refused even to exercise its discretion when the home of a settler, held by a righteous title, was to be confiscated at the demand of corporate greed. The niggardliness of Congress makes clerks, on salaries of twelve hundred to eighteen hundred dollars a year, untrained in the law, knowing nothing of the rules of evidence, judges of the law and facts in cases involving millions of dollars and thousands of homes. There is no worse chapter in the history of government than the facts we have to give showing the deliberate and heartless evictions of the European immigrant and the American settler in order to give their farms to covetous corporations. The land-grant roads have had millions of acres granted them by the Land Office in excess of the grants by Congress. The whole story is summed up in the recent remark of one who had thoroughly investigated the subject—that the history of the management of the land-grant roads by the Land Office is a history of the management of the Land Office by the railroads.

"No chapter in this story will be found of more sombre interest than the statements made as to the Supreme Court by the Senate Committee on Public Lands, in a report submitted by Senator Van Wyck recommending a bill to compel the railroads to pay taxes on their lands. Its decisions as to the titles of the railroads and the settlers to the lands, like those of a weathercock, have pointed the way the corporation blew its breath."

The summary of Mr. Lloyd's paper by the editor of the *Tribune*, as a preface to its publication, and the foregoing characterization of the acts of Congress, of the Land Office, and of the Supreme Court, by Mr. Lloyd, are fully justified by the alleged facts marshalled in the body of the sketch; and these allegations, after a year and a half of public scrutiny, stand unchallenged.

It would be difficult to conceive of a more reckless series of legislative acts than those through which the public domain in the United States has been squandered; and they are rendered either ignorant or vicious by the fact that in the vast empire surrendered almost totally without consideration, each legislator, in common with the people by and for whom he was deputed to act, had a personal interest. Through this series of acts of Congress the public domain was rudely wrested from its rightful owners, the people; the abnormal growth of corporate power unduly promoted, and a tendency to the concentration, in a few hands, of the landed estates of the country fostered.

The social and economic effects of this land legislation must be very great and far-reaching. Of the effects of the concentration of landed estates in a few hands we need not speak; they are sufficiently plain in England, Scotland, and Ireland.* But great corporations are a creation of yesterday; they are the product of steam. The railway, the factory, the mine of iron or coal, the furnace, the foundery, and the forge—these vast interests, chartered and endowed with certain muniments of sovereignty, are, as property, almost as indestructible as landed estates protected by the law of primogeniture. Men are trained from generation to generation to the care and conduct of them, and hence they are far less liable to waste and dispersion than private estates, which,

* "The more essential and important consideration is this—that whenever the few rapidly accumulate excessive wealth, the many must, necessarily, become comparatively poorer. . . . In every case in which we have traced out the efficient causes of the present depression we have found it to originate in customs, laws, or modes of action which are ethically unsound, if not positively immoral. Wars and excessive war armaments, loans to despots or for war purposes, the accumulation of vast wealth by individuals, excessive speculation, adulteration of manufactured goods, and, lastly, *our bad land system*, with its insecurity of tenure, excessive rents, confiscation of tenants' property, its common enclosures, evictions, and depopulation of the rural districts—all come under this category."—"Bad Times," pp. 65, 117. By Alfred Russel Wallace, LL.D. London: Macmillan & Co., 1885.

in transmission, may be subjected to disastrous changes of management. Being also enterprises of a semi-public character, the public is bound, as well as their owners, to see to their preservation.

It is to a small number of the greatest of these great companies that Congress has given an empire of land in the West—an area double that owned by the lords of England, Scotland, and Ireland. In the railway proprietor of the United States the two great elements of power are united—steam and land. It needs no argument to show that only the nation can control the proprietor of both the land and the railway—the sole means of reaching a market for the products of the land. The appellative—kingship—to the railway proprietor is not a misnomer. He is a real potentate, both by virtue of the multitudes of men over whom he rules autocratically, and of the magnitude of the revenue he wields. Presidents come and go, but he remains. Legislators investigate him and report upon him, but they are met by a flat denial of the authority of either State or nation to interfere with his "vested rights." He claims the right of himself and associates to control, absolutely, the internal commerce of the country; and this claim involves the pretence that they may confiscate merchandise seeking a market by charging, for carriage, the full value of the thing transported.

The railway and the factory, the two great products of steam, are new factors in the social problem, and to properly control them will require new wisdom; and the new wisdom is not to be drawn from old educational fountains.

State legislation has been as vicious as that of the nation. The people of nearly every State in the Union have been made the victims of great frauds and gross ignorance at the hands of their representatives. In nearly every State syndicates have been formed with the design of securing valuable franchises without consideration; and to effectuate such designs bribery has been freely and successfully resorted to in a vast number of cases. But rarely has the guilty agent of the guilty syndicate, or the perjured, purchased legislator been brought to justice, notwithstanding the fact that exposure has often followed the iniquity.

Evidence of the essentially European character of the American civilization is afforded by the prevalence of speculation. In Wall Street, New York, on the Board of Trade, Chicago, and on the exchanges of all large cities speculation rages. The real transactions of those business marts are very small, indeed, as compared with the transactions of a speculative character. On the New York Cotton Exchange the speculative trades in "futures" are thirty times more than the cotton sales. On the Chicago Board of Trade the speculative trades in "futures" are fifteen times more than the sales of grain and provisions, and so of the exchanges of all other large cities. To support these speculative operations fresh money is required to be constantly poured into the pool, and it is drawn from every class in the community. Very little of the "fresh money" is ever returned. Most of it remains in the hands of the pool managers, of those whose profession it is to manipulate the markets. Thus the fever of speculation extends from centre to circumference of the country, stimulating bad passions, creating distaste for labor, relieving the countryman of his surplus, and increasing the already overgrown fortune of the city operator. A writer on current topics, discussing this subject, says, "Put your finger on one of our great fortunes, and nine times out of ten you will feel underneath it the cold heart of some one who has mined on the San Francisco Stock Exchange, or packed pork on the Chicago Board of Trade, or built railroads in Wall Street." *

A sufficient number of the salient features of American civilization have been brought under review to show that the new continent has not borne new social fruits. Under extremely favorable physical conditions—a country of vast resources, a wide range of climates, and a soil of great fertility—we planted old social forces, and old social evils are in process of rapid development. We are transplanted Europeans, controlled by European mental and moral habitudes. And the virile force, evoked by the splendid physical opportunities of a vast new country, so intensifies the struggle for wealth and power, that European social abuses are not only reproduced, but sometimes exaggerated in this land of boasted equal political rights.

But notwithstanding the fact that social tendencies in America seem to be similar to those of Europe, it is upon America alone that the eyes of mankind rest with an expression of ardent hopefulness. Nor is this hope destitute of a basis of rationality. It is in the United States, for the first time in all the ages, that a good reason can be given for indulging the sentiment of patriotism. Love of country here is a due appreciation of the value of the right of suffrage. The private soldier who goes forth to

* "America does not now suffer from this cause [standing armies], but nowhere in the world have colossal fortunes, rabid speculation, and great monopolies reached so portentous a magnitude, or exerted so pernicious an influence."—"Bad Times," p. 80. By Alfred Russel Wallace, LL.D. London: Macmillan & Co., 1885.

fight the battles of the United States is a man and citizen, and upon his return from the field he may, with the ballot, devote to the education of his children a share of the estate of the army contractor who amassed a fortune while he defended the country. All the property in the United States, whether honestly or dishonestly acquired, is subject to the order of the ballot of the citizen. It may be taken for war purposes, and it may be taken for educational purposes. In the universality of the right of suffrage lies the power of correcting all social evils. It is through the right of suffrage that the wrongs inflicted upon a too patient people by corrupt and ignorant legislation may be ultimately righted. By the suffrages of the people the tax bill is voted; and it is through the tax bill that the vast estates of corporations and individuals, whether obtained by dishonest practices or not, may be made to contribute to the thorough edncation of all the children of the country. And it is through the sentiment of patriotism thus inspired that the right of universal suffrage in the United States is destined to preservation forever.

The late proposition to limit suffrage in the city of New York is explainable only on the theory put forth in this chapter, that our civilization is the product of European ideas—that we are Europeans in disguise. On any other hypothesis it would be amazing. It is even now sufficiently startling that the proposition to restrict suffrage should precede the proposition to make education universal by making it compulsory, and to purge it of its glaring defects. Every attempt to restrict the right of suffrage in the United States will, however, fail. The right of self-government can be taken from the American people only by force. The American citizen will not vote away his right to vote, as the careless Greek sold his freedom, and as the Chinaman sells his life.

That American social abuses do not spring from free suffrage is evident, because similar abuses exist in countries where the masses have little or no share in the government. Social evils are the product of defective education. So long as European educational methods prevail in this country, so long European social abuses will characterize our civilization. Our education is scant in quantity and poor in quality; hence the standard of the suffrage is lowered by the presence of ignorance and depravity. But when the suffrage shall be better informed, it will be more honest; and when it shall have become more honest and more intelligent, it will have gained the power to grapple with social abuses.

Such examination of history as we have been able to make fails to disclose any radical change in educational methods for three thousand years. The charge of Mr. Herbert Spencer against the schools of England, to wit, "That which our school courses leave almost entirely out we thus find to be that which most nearly concerns the business of life"—this charge applies with almost as much force to the schools of the United States as to the Greek and Roman schools of rhetoric and logic. Bacon's aphorism—"Education is the cultivation of a just and legitimate familiarity betwixt the mind and things"—is two hundred and fifty years old, but it has as yet exerted scarcely an appreciable influence upon the methods of our public schools. We still reverse the natural order of investigation proceeding from the abstract to the concrete, thus lumbering the mind of the student with trash which must be removed as a preliminary to the first step in the real work of education. We still impart a knowledge of words instead of a knowledge of things; we still ignore art, notwithstanding the fact that it is through art alone that education touches human life. We still inculcate contempt of labor, and teach the student how to "make his way in the world" by his wits, rather than by giving an equivalent for what he shall receive; and, worst of all, we continue, through subjective processes of thought, to charge the mind with selfishness, the essence of depravity.

Meantime, social problems press for a solution, a solution here and now. Our social problems cannot be settled as those of Europe have been, for two hundred years, by emigration. We have no Columbus, and if we had such an explorer, there is no new hemisphere for him to discover. The lesson of all history is, that selfish people cannot dwell together in unity. The struggle to secure more than a fair share of the products of the labor of all is sure to end in a quarrel; the quarrel ends in a revolution, and the revolution, under the glare of flames, drowns in blood the records of civilization. But in America the man must live with his fellows. As Mr. Henry D. Lloyd well says, in "Lords of Industry," "Our young men can no longer go West; they must go up or down. Not new land, but new virtue must be the outlet for the future. Our halt at the shores of the Pacific is a much more serious affair than that which brought our ancestors to a pause before the barriers of the Atlantic, and compelled them to practise living together for a few hundred years. We cannot hereafter, as in the past, recover freedom by going to the prairies; we must find it in the society of the good." *

* *North American Review*, June, 1884, p. 552.

If we are to find freedom only in the society of the good, we must create such a society—a society free from selfishness; for to the stability of society public spirit is essential, and with a pure public spirit selfishness is at war. Hence, in a system of education like the prevailing one, which promotes selfishness, the germs of social disintegration are present, and, from the beginning, the end may with absolute certainty be predicted. It follows that any hope of social reform is wholly irrational that does not spring from the postulate of a complete educational revolution.

CHAPTER XXVI.

HISTORY OF THE MANUAL ELEMENT IN EDUCATION.

The Kindergarten and the Manual Training School one in Principle. —Russia solved the Problem of Tool Instruction by Laboratory Processes.—The Initiatory Step by M. Victor Della-Vos, Director of the Imperial Technical School of Moscow in 1868.—Statement of Director Della-Vos as to the Origin, Progress, and Results of the New System of Training.—Its Introduction into all the Technical Schools of Russia.—Dr. John D. Runkle, President of the Massachusetts Institute of Technology, recommends the Russian System in 1876, and it is adopted. — Statement of Dr. Runkle as to how he was led to the adoption of the Russian System.—Dr. Woodward, of Washington University, St. Louis, Mo., establishes the second School in this Country.—His Historical Note in the Prospectus of 1882–83.—First Class graduated 1883.—Manual Training in the Agricultural Colleges—In Boston, in New Haven, in Baltimore, in San Francisco, and other places.—Manual Training at the Meeting of the National Educational Association, 1884.—Kindergarten and Manual Training Exhibits. — Prof. Felix Adler's School in New York City—the most Comprehensive School in the World.—The Chicago Manual Training School the first Independent Institution of the Kind—its Inception; its Incorporation; its Opening. Its Director, Dr. Belfield.—His Inaugural Address.—Manual Training in the Public Schools of Philadelphia.—Manual Training in twenty-four States.—Revolutionizing a Texas College.—Local Option Law in Massachusetts.—Department of Domestic Economy in the Iowa Agricultural College.—Manual Training in Tennessee, in the University of Michigan, in the National Educational Association, in Ohio.—The Toledo School for both Sexes.—The Importance of the Education of Woman.—The Slöjd Schools of Europe.

The principle of the manual training school exists in the kindergarten, and for that principle we are indebted directly to Froebel, and indirectly to Pestalozzi, Come-

M. VICTOR DELLA-VOS, THE FOUNDER OF MANUAL TRAINING IN RUSSIA.

nius, Rousseau, and Bacon. But it was reserved for Russia to solve the problem of tool instruction by the laboratory process, and make it the foundation of a great reform in education. The initiatory step was taken in 1868 by M. Victor Della-Vos, Director of the Imperial Technical School of Moscow. The following statement is extracted from the account given by Director Della-Vos of the exhibit of the Moscow school at Philadelphia (Centennial of 1876), and at the Paris Exposition in 1878, as best showing the inception of the new education:

"In 1868 the school council considered it indispensable, in order to secure the systematical teaching of elementary practical work, as well as for the more convenient supervision of the pupils while practically employed, to separate entirely the school workshops from the mechanical works in which the orders from private individuals are executed, admitting pupils to the latter only when they have perfectly acquired the principles of practical labor.

"By the separation alone of the school workshops from the mechanical works, the principal aim was, however, far from being attained. It was found necessary to work out such a method of teaching the elementary principles of mechanical art as, firstly, should demand the least possible length of time for their acquirement; secondly, should increase the facility of the supervision of the graded employment of the pupils; thirdly, should impart to the study of practical work the character of a sound systematical acquirement of knowledge; and fourthly and lastly, should facilitate the demonstration of the progress of every pupil at every stated time. Everybody is well aware that the successful study of any art whatsoever, free-hand or linear drawing, music, singing, painting, etc., is only attainable when the first attempts at any of them are strictly subject to the laws of gradation and successiveness, when every student adheres to a definite method or school, surmounting little by little, and by certain degrees, the difficulties encountered.

"All those arts which we have just named possess a method of study which has been well worked out and defined, because, since they have long constituted a part of the education of the well-instructed classes of people, they could not but become subject to scientific analysis, could not but become the objects of investigation, with a view of defining those conditions which might render the study of them as easy and well regulated as possible.

"If we except the attempts made in France in the year 1867 by the celebrated and learned mechanical engineer, A. Cler, to form a collection of models for the practical study of the principal methods of forging and welding iron and steel, as well as the chief parts of joiners' work, and this with a purely demonstrative aim, no one, as far as we are aware, has hitherto been actively engaged in the working out of this question in its application to the study of hand labor in workshops. To the Imperial Technical School belongs the initiative in the introduction of a systematical method of teaching the arts of turning, carpentering, fitting, and forging.

"To the knowledge and experience in these specialties, of the gentlemen intrusted with the management of the school workshops, and to their warm sympathy in the matter of practical education, we are indebted for the drawing up of the programme of systematical instruction in the mechanical arts, its introduction in the year 1868 into the workshops, and also for the preparation of the necessary auxiliaries to study. In the year 1870, at the exhibition of manufactures at St. Petersburg, the school exhibited its methods of teaching mechanical arts, and from that time they have been common to all the technical schools of Russia.

"And now (1878) we present our system of instruction, not as a project, but as an accomplished fact, confirmed by the long experience of ten years of success in its results."

For the introduction of the manual element in education to the United States we are indebted to the intellectual acumen of Dr. John D. Runkle, Ph.D., LL.D., Walker Professor of Mathematics, Institute of Technology, Boston, Mass. In 1876 Doctor Runkle was President of the Massachusetts Institute of Technology. In his official report for that year he gave an exhaustive exposition of the Russian system, in the course of which he said,

"We went to Philadelphia, therefore, earnestly seeking for light in this as well as in all other directions, and this special report is now made to ask your attention to a fundamental, and, as I think, complete solution of this most important problem of practical mechanism for engineers. The question is simply this, Can a system of shop-work instruction be devised of sufficient range and quality which will not consume more time than ought to be spared from the indispensable studies?

"This question has been answered triumphantly in the affirmative, and the answer comes from Russia. It gives me the greatest pleasure to call your attention to the exhibit made by the Imperial Technical Schools of St. Petersburg and Moscow, consisting entirely of collections of tools and samples of shop-work by students, illustrating the system which has made these magnificent results possible."

In conclusion Doctor Runkle made the following earnest recommendation:

"In the light of the experience which Russia brings us, not only in the form of a proposed system, but proved by several years of experience in more than a single school, it seems to me that the duty of the Institute is plain. We should, without delay, complete our course in Mechanical Engineering by adding a series of instruction shops, which I earnestly recommend."

In accordance with this recommendation the "new school of Mechanic Arts" was created, and made part of the Massachusetts Institute of Technology.

In his report for 1877 Doctor Runkle said,

"The plan announced in my last report, of building a series of shops [laboratories] in which to teach the students in the department of Mechanical Engineering and others the use of tools, and the fundamental steps in the art of construction, in accordance with the Russian system, as exhibited at Philadelphia in 1876, has been carried steadily forward, and I have now the pleasure of announcing its near completion."

Reference is also made in the same report to the action of the trustees of the Institute in acknowledging the reception of certain models illustrating the system of Mechanic Art education, presented by the government of Russia, as follows:

"At a meeting of the Corporation of the Massachusetts Institute of Technology, held November 20, 1877, a communication from his Excellency, Hon. George H. Boker, American Minister at St. Petersburg, was read, announcing the gift to this Institute of eight cases of

DR. JOHN D. RUNKLE, THE FOUNDER OF MANUAL TRAINING IN THE UNITED STATES.

models, illustrating the system of Mechanic Art education, as devised and so successfully applied at the Imperial Technical School of Moscow. The undersigned have been charged with the agreeable duty of transmitting to his Imperial Highness the following resolutions:

"*Resolved*, That the Corporation of the Massachusetts Institute of Technology takes this opportunity to cordially congratulate his Imperial Highness, Prince Pierre d'Oldenbourg, that, at the Imperial Technical School of Moscow, education in the Mechanic Arts has been for the first time based upon philosophical and purely educational grounds, fully justifying for it the title of the 'Russian system.'

"*Resolved*, That this Corporation hereby tenders its grateful thanks to his Imperial Highness for his most valuable gift, with the assurance that these models will be of the greatest aid in promoting Mechanic Art education not only in the School of this Institute, but in all similar schools throughout the United States."

Appreciating the value of the services rendered to the cause of the new education by Dr. Runkle, in introducing to the schools of the United States tool practice by laboratory methods, and desiring to inform the public of the course of thought which led to results so important, the author addressed him on the subject. His reply, under date of May 22, 1884, is in substance as follows:

"From the first the course in Mechanical Engineering has been an important one in the Institute of Technology. A few students came with a knowledge of shop-work, and had a clear field open to them on graduation, but the larger number found it difficult to enter upon their professional work without first taking one or two years of apprenticeship. This always seemed to me a fault in the education, and yet I did not see the way to remedy it without building up manufacturing works in connection with the school—a step which I knew to be an inversion of a true educational method.

"At Philadelphia, in 1876, almost the first thing I saw was a small case containing three series of models—one of chipping and filing, one of forging, and one of machine-tool work. I saw at once that they were not parts of machines, but simply graded models for teaching the manipulations in those arts. In an instant the problem I had been seeking to solve was clear to my mind; a plain distinction between a Mechanic Art and its application in some special trade became apparent.

"My first work was to build up at the Institute a series of Mechanic Art shops, or laboratories, to teach these arts, just as we teach chemistry and physics by the same means. At the same time I believed that this discipline could be made a part of general education, just as we make the sciences available for the same end through laboratory instruction.

"All teaching has in an important sense a double purpose: first, the cultivation of the powers of the individual, and second, the pursuit of similar subjects, by substantially the same means, as a professional end. Now we use our shops [laboratories] both for educational and professional ends. . . . In brief, we teach the mechanic arts by laboratory methods, and the student applies the special skill and knowledge acquired, or not, as circumstances or his inclinations dictate."

The second manual training school in this country was founded as a department of Washington University, St. Louis, Mo., by Dr. C. M. Woodward. In a paper read before the St. Louis Social Science Association, May 16, 1878, Dr. Woodward discussed the subject of education both philosophically and practically. In the course of his address he gave a full account of the Russian system of manual training as expounded by Dr. Runkle, endorsed it, and recommended it to the people of St. Louis as the true method of education in the following pregnant sentence: "The manual education which begins in the kindergarten, before the children are able to read a word, should never cease." *

In the same paper Dr. Woodward thus modestly describes the beginning of the school which is now one of the most highly-esteemed educational institutions of St. Louis:

"With the aid of our stanch friend, Mr. Gottlieb Conzelman, we fitted up during last summer a wood-working shop, with work-benches and vises for eighteen students; a second shop for vise-work upon metals and for machine-work; and a third with a single outfit of blacksmith's tools. During the last few months systematic instruction has been given to different classes in all these shops. Special attention has been paid to the use of wood-working hand-tools, to wood-turning, and to filing."

These tentative steps promoted a healthy public sentiment, and attracted the attention of several wealthy men, who in 1879 contributed the funds for the permanent foundation of the school. The prospectus for the year

* The pressing problem of the time in methods of practical education is to devise suitable manual exercises for the school period embraced in the interim between the end of the kindergarten series of lessons and the beginning of the series of laboratory exercises described in this work — the grammar-school period — for children of both sexes from six to fourteen years of age.

1882–83 contains the following "historical note," which shows great progress:

"The ordinance establishing the Manual Training School was adopted by the Board of Directors of the University, June 6, 1879.

"The lot was purchased and the building begun in August of the same year. In the November following a prospectus of the school was published. In June, 1880, the building being partially equipped, was opened for public inspection, and a class of boys was examined for admission. On September 6, 1880, the school began with a single class of about fifty pupils. The whole number enrolled during the year was sixty-seven. A public exhibition of drawing and shop-work was given June 16, 1881.

"The *second year* of the school opened September 12, 1881, and closed June 14, 1882. There were two classes, sixty-one pupils belonging to the first year, and forty-six to the second year, making one hundred and seven in all. Of the second-year class, forty-two had attended the school the previous year.

"The *third year* of the school will open on September 11th, when three classes will be present.

"The large addition now in progress (June, 1882) is to be completed and furnished by the day set for the examination of candidates for admission, September 8th. The number of pupils in the new first-year class is to be limited to one hundred. *Nearly one-half of that number have already been received.*"

The capacity of the school since the completion of the "addition" alluded to in the "historical note" is two hundred and forty students. The first class was graduated in June, 1883; the second class in June, 1884. The establishment of this excellent school is due first to the energy and educational foresight of Dr. Woodward, and second, to the munificent money donations of three citizens of St. Louis—Mr. Edwin Harrison, Mr. Samuel Cupples, and Mr. Gottlieb Conzelman. Other citizens emulated their noble example, and the result was a sufficient fund for the support of the school, whose purpose is to demonstrate the practicability of uniting manual and mental instruction in the public schools of St. Louis and of the country. With a single further quotation from the prospectus of the second great manual training school in the United States, on the subject of labor, we close this too brief notice :

"One great object of the school is to foster a higher appreciation of the value and dignity of intelligent labor, and the worth and respectability of laboring men. A boy who sees nothing in manual labor but mere brute force despises both labor and the laborer. With the acquisition of skill in himself comes the ability and willingness to recognize skill in his fellows. When once he appreciates skill in handicraft, he regards the workman with sympathy and respect."

Considerable progress in manual training has been made in the State agricultural colleges of the country. In twelve of these colleges drawing and tool practice have been introduced. Generally the tool practice covers pattern-making, blacksmithing, moulding and founding, forging and bench-work, and machine-tool work in iron. The most pronounced success has been achieved at Purdue University, Lafayette, Ind., under the directorship of Prof. Wm. F. M. Goss, who graduated from the school of Mechanic Arts of the Massachusetts Institute of Technology in 1879.

Manual training in connection with the public-school system of education has been inaugurated in Boston and Milford, Mass.; New Haven, and the State Normal School, New Britain, Conn.; Omaha, Neb.;* Eau Claire, Wis.;† Moline, Peru, and the Cook County Normal School, Normal Park, Ill.; Montclair, N. J.; Cleveland and Barnesville, Ohio; San Francisco, Cal.; and Baltimore, Md.

On the occasion of the annual meeting of 1884 of the National Educational Association of the United States, at Madison, Wis., manual training received a very large share of the attention of educators. Very creditable exhibits of various manipulations in wood, iron, and steel were made by the following institutions, namely, the Massachusetts Institute of Technology, Purdue University, the St. Louis Manual Training School, the Illinois Industrial University, the University of Wisconsin, and the Spring Garden Institute of Philadelphia. There were also about thirty kindergarten exhibits, and a large number of exhibits of specimens of drawing from public schools in various parts of the country.

Prof. Felix Adler's educational enterprise in the city of New York—The Workingman's School and Free Kindergarten — is unique in this that, while it is entirely a work of charity, it is the most comprehensive educational institution in existence, as appears from the following description of its course of instruction:

"The Workingman's School and Free Kindergarten form one institution. The children are admitted at the

* In charge of Albert M. Bumann, B.S., graduate of the St. Louis Manual Training School, class of 1885.

† In charge of William F. Barnes, B.S., graduate of the St. Louis Manual Training School, class of 1885.

age of three to the kindergarten. They are graduated from it at six, and enter the workingman's school. They remain in the school till they are thirteen or fourteen years of age. Thereafter those who show decided ability receive higher technical instruction. For the others who leave the school proper and are sent to work, a series of evening classes will be opened, in which their industrial and general education will be continued in various directions. This graduate course of the workingman's school is intended to extend up to the eighteenth or twenty-first year.

"From the third year up to manhood and womanhood—such," says Prof. Adler, "is the scope embraced by the purposes of our institution!"

The following extracts from a late report of the principal of the school, Mr. G. Bamberger, on its "purposes," show that they are identical with those of the so-called manual training school, and also that its methods are similar:

"We, therefore, have undertaken to institute a reform in education in the following two ways: We begin industrial instruction at the very earliest age possible. Already in our kindergarten we lay the foundation for the system of work instruction that is to follow. In the school proper, then, we seek to bridge over the interval lying between the preparatory kindergarten training and the specialized instruction of the technical school, utilizing the school age itself for the development of industrial ability. This, however, is only one characteristic feature of our institution. The other, and the capital one, is, that we seek to combine industrial instruction organically with the ordinary branches of instruction, thus using it not only for the material purpose of creating skill, but also ideally as a factor of mind-education. To our knowledge, such an application of work instruction has nowhere as yet been attempted, either abroad or in this country. . . .

"In the teaching of history to these young children we hold it essential that the teacher should be entirely independent of any text-book, and able to freely handle the vast material at his disposal, and to draw from it, as from an endless storehouse, with fixed and definite purpose. We attach even greater importance to the moral than to the intellectual significance of history. The benefits which the understanding, the memory, and the imagination derive from the study of history are not small. But history, considered as a realm of actions, can be made especially fruitful of sound influence upon the active, moral side of human nature. The moral judgment is strengthened by a knowledge of the evolution of mankind in good and evil. The moral feelings are purified by abhorrence of the vices of the past, and by admiration of examples of greatness and virtue. Text-books are not to be discarded, but their choice is a matter of great difficulty. Thus, all books in which historical instruction is given in the shape of printed questions and answers are highly objectionable. They are convenient bridges which lead to nothing."

The following extract from a late report of Prof. Adler shows the purpose of the establishment of what he calls the "model school" to be identical with that of the projectors of the St. Louis and Chicago manual training schools, namely, the ultimate adoption by the public schools of the country of a far more rational system of instruction than that which at present prevails. He says,

"It seemed to us, therefore, far more necessary, far more calculated to really advance the public good, that one model school should be erected in which the entire system of rational and liberal education for the children of the poorer class might be exhibited from beginning to end. We ventured to hope that such an example, having once been set, would not be without effect upon the common-school system at large, and that the extension of our work would proceed by the natural course of the 'survival of what is fittest.' It was decided, therefore, that the twenty-five graduates from the kindergarten should be invited to remain with us, that a complete school should be instituted, and that a teacher should be at once appointed to take in hand the instruction of the lowest class. The munificence of Mr. Joseph Seligman, to whose name we cannot refer without gratitude and respect, at this stage enabled us to go on with our undertaking, when the dearth of funds would otherwise have compelled us to wait, or perhaps desist altogether. His timely gift of ten thousand dollars was the means of starting the school, and on this as well as on other accounts his memory deserves to be cherished by those who cherish the educational interests of the people."

The Chicago Manual Training School is the only independent educational institution of the kind in the world. All the schools of this character to which reference has been made in this chapter are departments of colleges or institutes of technology. The Chicago school is unique in another respect: it owes its origin entirely to laymen. Professional educators labored long and earnestly to found the schools we have described, but the Chicago school was inspired by men unknown in the field of educational enterprise, advocated by a secular daily journal, and established by an association of merchants, manufacturers, and bankers. For many years the *Chicago Tribune* had very freely and severely criticised the educational methods of the public schools. Early in the year 1881 its editorial columns were opened to the author of this work, who began and continued, therein, the advocacy of the establishment of a manual training school in Chicago, as a tentative step towards the incorporation in the curriculum of the public schools, of more practical methods of instruction.

The editorial advocacy of the *Tribune* was continued for twelve months, articles appearing about once a week, without apparent effect beyond provoking a controversy with certain professional educators, who attacked the positions assumed by the *Tribune*. But a public sentiment had been created on the subject, and the Commercial Club was destined soon to embody that sentiment in action. At its regular monthly meeting, March 25, 1882, the subject of reform in methods of education was discussed by members of the club, and by men invited to be present for that purpose; the establishment of a school was resolved upon, and $100,000 pledged for its support.

The Chicago Manual Training School Association was incorporated April 11, 1883; the corner-stone of its building was laid September 24, 1883; and the sessions of the school commenced on the 4th of February, 1884, with a class of seventy-two students, "selected by examination from one hundred and thirty applicants, under the directorship of Henry H. Belfield, A.M., Ph.D."

The Board of Trustees consists of E. W. Blatchford, president; R. T. Crane, vice-president; Marshall Field, treasurer; William A. Fuller, secretary; John Crerar, John W. Doane, N. K. Fairbank, Edson Keith, and George M. Pullman.

The object of the school is stated in the articles of incorporation as follows:

"Instruction and practice in the use of tools, with such instruction as may be deemed necessary in mathematics, drawing, and the English branches of a high-school course. The tool instruction as at present contemplated shall include carpentry, wood-turning, pattern-making, iron chipping and filing, forge-work, brazing and soldering, the use of machine-shop tools, and such other instruction of a similar character as may be deemed advisable to add to the foregoing from time to time, it being the intention to divide the working hours of the students, as nearly as possible, equally between manual and mental exercises."

From the first annual catalogue, under the title "Building and Equipment," we extract the following:

"The school building is beautifully located on Michigan Avenue, and contains ample accommodations, in rooms for study and work, for several hundred pupils.

"The equipment in the mechanical department consists mainly, at present, of twenty-four cabinet-makers' benches; bench and lathe tools of the best quality for seventy-two boys; twenty-four speed lathes, twelve-inch swing, thirty inches between centres; a fifty-two horse-power Corliss engine, twelve-inch cylinder, thirty-six inch stroke; two tubular boilers, forty inches in diameter, fourteen feet long. The Corliss engine, boilers, and lathes were made especially for the school.

"A very valuable scientific library of nearly five hundred volumes, the property of the American Electrical Society, has been placed in the school. To this library, which is particularly rich in works pertaining to electricity and chemistry, but which contains also cyclopedias, dictionaries, and other works of reference, the pupils have access.

"The Blatchford Literary Society, an organization of pupils for improvement in composition, debate, etc., has lately had a handsome donation of money for the purchase of books to be placed in their alcove in the school library. Several periodicals are regularly placed on the library tables through the generosity of the publishers.

"By the kindness of Dr. Wm. F. Poole, librarian, pupils are able to obtain books from the Chicago Public Library on unusually favorable conditions."

Thus the Chicago Manual Training School, a practical school, a school of instruction in things, a school after Bacon's "own heart," sprang from the brain of a number of plain, practical business men, full-armed, as Minerva from the brain of Jupiter.

The Trustees were fortunate in securing Dr. Belfield for the directorship of the school. Before the introduction of the new education to this country, eleven years ago, while Russia was struggling with the problem of tool practice by the laboratory method, Dr. Belfield urged the need of manual training in the public schools of Chicago, in which he was a teacher. He was met with derision; but the president of the Board of Education of Chicago and the superintendent of schools are now advocates of the new system of training.

In conclusion we present the following extracts from the inaugural address of Dr. Belfield, delivered before the Chicago Manual Training School Association, June 19, 1884, as embodying the results of his experience and observation as to the value of the new system of training:

"The distinctive feature of the manual training school is the education of the mind, and of the hand as the agent of the mind. The time of the pupil in school is about equally divided between the study of books and the study of things; between the academic work on the one hand, and the drawing and shop-work on the other. Observe, I do not say between *school-work* and *shop-work*, for the shop is as much a school as is any other part of the establishment. Nor do I mean that the shop gives an education of the hand alone, and the class-room an education of the brain; but I mean that the shop educates *hand and brain.* That the *hand* is educated I need not stop to prove; but the shop educates the mind also.

"Had you been in the wood-working room of this school a few hours ago, what would you have seen? Twenty-four boys at work at lathes driven by a powerful engine. Are any idle? No. Are any inattentive to their work? No; you notice the closest and most earnest attention, frequently approaching abstraction. Here, then, is the cultivation of a most important faculty of the mind, attention, the power of concentration; and it is worthy of remark that this attention is not an *enforced* attention, but is cheerful, voluntary, and unremitting.

"The young workman is engaged on a problem in wood, just as, a few hours earlier, he was engaged on a problem in algebra. He has before him a drawing made to a scale. The problem is this: He must gain a clear conception of the object represented by the drawing; he must *imagine* it; he must select or cut a block of wood of the proper dimensions and of the right quality. It must not be too large, for he must guard against waste of material and waste of time. It must be large enough, for there must be no incompleteness about the finished product of his labor. Observe him as the work grows under his hand; observe the selecting of the proper tools for the different parts of the process; observe the careful measuring, the watchful eye upon the position of the chisel, the speed of the lathe, the gradual approach of the once rectangular block to the model which exists in his brain—and you must admit that this work demands and develops, not manual dexterity alone, but attention, observation, imagination, judgment, reasoning. . . .

"My own opinion is that an hour in the shop of a well-conducted manual training school develops as much mental strength as an hour devoted to Virgil or Legendre. . . .

"But of this I am confident, that three years of a manual training school will give at least as much purely intellectual growth as three years of the ordinary high school, because, as has been said, every school hour, whether spent in the class-room, the drawing-room, or in the shop, is an hour devoted to intellectual training. And I am also convinced that the manual training school boy's comprehension of some essential branches of knowledge will be as far superior to that of the other boy's, as the realization of the grandeur and beauty of the Alps to the man who has seen their glories is superior to the conception of him who has merely read of them. . . .

"And here is the mistake of those who would degrade a manual training school into a manufacturing establishment. The fact should never be lost sight of for an instant that the product of the school should be, not the polished article of furniture, not the perfect piece of machinery, but the polished, perfect *boy*. The acquisition of industrial skill should be the means of promoting the general education of the pupil; the education of the hand should be the means of more completely and more efficaciously educating the brain. . . .

"Take two boys, one with little or no education, the other a high-school graduate; let them enter the machine-shop of a large manufactory, beginning, as boys ignorant of the technique of the trade must begin, at the lowest round of the ladder. It cannot be doubted that in three or four years the high-school graduate, if he had been willing to do the drudgery incident to the place, would have reached a higher position than the other boy, and would be in a fair way to succeed to some responsible post in the establishment. But the graduate of the manual training school, by reason of his superior knowledge of machinery and materials, his skill in the use of tools, added to his general mental training, would begin at the point reached by the high-school boy after his years of apprenticeship. From the day of his entrance into the factory he would be conspicuous. While the other boys would stand in the presence of the huge Titan of the shop lost in the wonder of ignorance, the manual training boy would gaze with delight on the marvel of mechanism, wrapped in the admiration begotten of a thorough understanding of its construction, and strong in the consciousness of his mastery of it."

Manual training was introduced in the Pennsylvania State College, experimentally, about three years ago. In 1883 the course was "greatly extended," and in September, 1884, it went into full operation. The course is substantially the same as that of the Chicago school; and that it was the outgrowth of the Russian system, and inspired by Dr. Runkle, is shown by the following extract from a circular lately issued by Prof. Louis E. Reber:

"Some may think that the variety of operations in the mechanic arts is so great as to make it impossible to give the student any real knowledge in the time at his disposal. It should be borne in mind, however, that this multiplicity of processes may be reduced to a small number of manual operations, and the numerous tools employed are only modifications of, or convenient substitutes for, a few tools which are in general use."

A course in tool practice by the laboratory method has been made part of the curriculum of the College of the City of New York.* I am permitted to make an extract from a letter written in August last by Alfred G. Compton, Professor of Applied Mathematics of the College of the City of New York, to Dr. Runkle. I print this extract to show the exacting nature of the demands made upon instructors by the new education. It is as follows:

"We are anxious to find, by the opening of our term in September, a competent instructor in wood-working for our course in mechanic arts, now in its second year. He should be a good and ready draughtsman, skilful in perspective and projections, and ready in black-board sketching, besides being acquainted with the use of tools, and apt at class-teaching. He will have at first $1000 a year."

The lack of competent instructors is the most serious difficulty which the new education is destined to encounter. The desire to adopt tool practice is so widespread among the people that educators, whether willing or oth-

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* "The first report of the Industrial Educational Association of New York gives a list of thirty-one schools in that city in which industrial education is furnished."—Address of Prof. S. R. Thompson, Industrial Department of the National Educational Association, Saratoga Springs, N. Y., July, 1885.

erwise, are compelled to attempt to gratify the demand. At the same time the force of competent instructors is very small, and the danger is that the new system of education will be brought into disrepute through the failure of its proper administration.

In 1882 Mr. Paul Tulane, of Princeton, N. J., made a large donation, consisting of his realty in the city of New Orleans, in aid of education in the State of Louisiana. In 1884 the University bearing its donor's name —Tulane—came into existence. In the deed of donation Mr. Tulane declared that by the term education he meant to "foster such a course of intellectual development as shall be useful and of solid worth, and not be merely ornamental or superficial." Hence manual training has been made a prominent feature of the institution.*

There is in operation at Crozet, Va., a manual training school called, after its founder, Mr. Samuel Miller, "The Miller Manual Labor School;" but of the methods of training pursued at this school the author is not accurately informed.

Girard College, dedicated nearly forty years ago, has adopted manual training. In response to a letter by the author, asking for information, Mr. W. Heyward Drayton, of Philadelphia, gives the following historical sketch of the introduction and progress of tool practice by the laboratory method in that noble institution:

* John M. Ordway, A.M., late Professor of Metallurgy and Industrial Chemistry of the Massachusetts Institute of Technology, has been called to New Orleans to organize and direct the manual training department of the institution; and he is assisted by Charles A. Heath, B.S., and Everett E. Hapgood, graduates of the School of Mechanic Arts of the Massachusetts Institute of Technology.

"From time to time some of the directors recognized the importance of mechanical instruction, but after one or two attempts further efforts in this direction were abandoned, as those proved utter failures. It was not until Dr. Runkle, of the Massachusetts Institute of Technology, at the instance of the late Mr. William Welsh, then president of the Board of Directors of City Trusts, delivered a short address on the subject in the lecture-room of the Franklin Institute in this city, that any practical mode of introducing this branch of study into the college was presented.

"... Following as nearly as possible the scheme suggested by Dr. Runkle, and aided by many suggestions from him, in April, 1882, we began to instruct the larger boys to use tools in several kinds of metals. We were so fortunate as to secure the services of a very competent and enthusiastic instructor, who confined his instruction merely to teaching the use of tools, but without any pretence of teaching any trade. The result of two years' experience has been so satisfactory that our boys leave the college to go to workshops, where they secure sufficient wages to support them at once; and they have, in many cases, been found so expert that in a few months their wages have been increased. We have been so encouraged by this as a substitute for apprenticing lads, which is fast becoming impossible, that we have just erected commodious workshops [laboratories], in which, on the same system, but to many more boys, we propose to teach the use of tools in wood-work also, as we have heretofore taught in metals. To this time we have been compelled, from want of facilities, to confine our instruction to about one hundred and seventy-five boys. We expect next month (October, 1884) to increase the number to three hundred—only being limited by the youth of the pupils, many of whom are too young to permit of their handling tools."

Manual training has been made part of the curriculum of the Agricultural and Mechanical College of Auburn, Ala., and the department is under the direction of a graduate of the Massachusetts Institute of Technology.*

Manual training has been adopted as a branch of education in the Denver (Col.) University, and the director of the department is a graduate of the manual training department of the Washington University of St. Louis, Mo.†

The present year (1885) witnesses a very important addition to the list of manual training schools—that of Philadelphia.

It is not too much to say that Mr. James MacAlister has revolutionized the public schools of Philadelphia in the short period of two years during which he has held the office of superintendent; and the last wave of the revolution reveals a fully-equipped manual training school as part of the public-school system of the conservative, grand old Quaker city. And this practical element in education is to be free to all public-school boys fourteen years of age, who can show themselves qualified to enter, as witness the following "rules" of the Philadelphia public schools:

"Promotions to the Manual Training School shall be made at the close of the June term, from the Twelfth

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* George H. Bryant, B.S., graduate of the Massachusetts Institute of Technology, class of 1883.

† C. H. Wright, B.S., graduate of the St. Louis Manual Training School, class of 1885.

Grade, or any higher grade, of the Boys' Grammar, Consolidated and Combined Schools; but no boy shall be promoted who is under fourteen years of age.

"It shall be the duty of the Principals of the several Boys' Grammar, Consolidated and Combined Schools, to certify to the superintendent of schools the names of all boys of the proper age who have finished the course of study in the Twelfth Grade, or any higher grade, and are desirous of promotion to the Manual Training School."

In calling the attention of the public to the establishment of a manual training school as part of the educational system of Philadelphia, a committee of the City Board of Education say, under date of June 10, 1885,

"The undersigned desire to call attention to the new manual training school to be opened in this city next September. It is intended for boys who have finished the Twelfth Grade, or any higher grade, of the Grammar-school course. The instruction will embrace a thorough course, so far as it goes, in English, mathematics, free-hand and mechanical drawing, and the fundamental sciences; but in addition to these branches a carefully graded course of manual training will form a leading feature of the school. This manual training is intended to give the boys such a knowledge of the tools and materials employed in the chief industrial pursuits of our time as shall place them in more direct and sympathetic relations with the great activities of the business world. The school will make our public education not only more complete and symmetrical in character than it has been heretofore, but it will be at the same time better adapted to enable the pupils to win their way in life. No matter what future a parent may have marked out for his boy—whether he be intended for an industrial, a mercantile, or a professional occupation, it is believed that such an education will be of immense advantage to him. Upon the industries of the world, to a much larger extent than ever before in its history, depend the progress, the prosperity, the happiness of society. To prepare boys for this condition of things will be the aim of this school. The entire course of instruction and training will be *practical* in the largest and best sense of that term. The culture it gives will include the hand as well as the head, and its graduates will be trained to work as well as to think. The course will extend over a period of three years, but it is so arranged that boys whose intended pursuits in life will not warrant spending so much time may participate in its advantages for a shorter period before entering upon other studies or a permanent occupation.

"The Manual Training School has been organized in response to a growing sentiment respecting the character of public education which has been strongly manifested in Philadelphia, and the Board of Public Education believe that the movement, when fully understood, will meet with the cordial approval of our people. Your careful consideration of the nature and objects which the school seeks to accomplish is respectfully solicited."

This act of the school authorities of the city of Philadelphia is the strongest popular endorsement the theory of manual training as an element of education has received. It commits a great city to a fair trial of the new education under the most favorable auspices—under the conduct of Mr. James MacAlister, one of the most accomplished, as well as most sternly practical educators in the United States.

But this is only part of a general system of manual training introduced throughout the whole course of instruction given in the public schools of Philadelphia. There are kindergartens (sub-primaries) for children from three to six years of age, and an industrial art department for all the students (of both sexes) of the grammar schools. In this latter department the course of training comprises "drawing and design," "modelling," "wood-carving," "carpentry and joinery," and "metal work." These courses, including manual training proper, "at the top," form a comprehensive system of head and hand training known as the new education. Mr. MacAlister says, "The conviction is gradually obtaining among the members of the Board of Education [of Philadelphia], and in the public mind, that every child should receive manual training; that a complete education implies the training of the hand in connection with the training of the mind; and that this feature must ultimately be incorporated into the public education. What is this but the realization of the principles which every great thinker and reformer in education has insisted upon, from Comenius, Locke, and Rousseau, to Pestalozzi, Froebel, and Spencer!" *

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* In a recent letter to the author, Mr. MacAlister re-enforces the observations quoted in the text. He says,

"I wish you to understand that all my own convictions and action in connection with this movement are based upon what in my judgment should constitute an education fitted to prepare a human being for the social conditions of to-day, *and not merely upon the industrial demands of our time.* . . . I believe there is a great future for the manual training movement in Philadelphia. I feel encouraged to go forward with the work. The great principles which underlie the system are with me intense convictions; *they mean nothing less than a revolution in education.* The great ideas of the reformers of school training must be realized in the public schools, or they will fail in accomplishing the ends for which they were instituted and have been maintained."

The rapid progress of the revolution in education is shown by the fact that manual training in some form has been adopted in certain of the schools of at least twenty-four of the States of the American Union.

In some of the higher educational institutions the new education is warmly welcomed, while in others public sentiment alone compels its adoption. The State Agricultural and Mechanical College of Texas has been revolutionized in this way. A member of the Faculty* writes as follows:

"This institution was opened on the 4th of October, 1876. In spite of its name, the conditions of its endowment, and its avowed object, it was founded on the plan of the old classical and mathematical college, and had no industrial features whatever till the beginning of the year 1880. At that time the public sentiment of the State had condemned so decidedly and repeatedly the misappropriation of the funds, and perversion of the energies of the college under its administration as a literary school, that the directors found it necessary to reorganize it by accepting the resignation of the members of the faculty without exception, and calling in a new corps of instructors. In 1880–81 a large dormitory building was converted into a shop [laboratory]. This was fitted with tools for elementary instruction in wood-working for the accommodation of about fifty students. A small metal-working plant was also erected, the whole being furnished with power from a twelve-horse-power engine. Since that time a brick shop [laboratory] has been provided for the accommodation of the metal-working machinery, which now includes the principal machines used

* H. H. Dinwiddie, Professor of Chemistry, Chairman of the Faculty.

in ordinary iron-working, all driven by a twenty-horse-power engine."

Massachusetts, the cradle of the American common-school system, is the first State to legalize by statute the new education, placing manual training on an equal footing with mental training, by the following act:

"Section I. of Chapter XLIV. of the Public Statutes, relating to the branches of instruction to be taught in public schools, is amended by striking out in the eighth line the words 'and hygiene,' and inserting instead the words 'hygiene and the elementary use of hand-tools;' and in any city or town where such tools shall be introduced they shall be purchased by the school committee at the expense of such city or town, and loaned to such pupils as may be allowed to use them free of charge, subject to such rules and regulations, as to care and custody, as the school committee may prescribe." *

The Legislature of Connecticut adopted a similar statute last year (1884).

The Iowa Agricultural College is the first educational institution in the country to recognize the importance of instruction in the arts of home life. In this college domestic economy has been elevated to the dignity of a department called the "School of Domestic Economy," with the following "special faculty:"

The President, Mrs. Emma P. Ewing, Dean	*Domestic Economy.*
J. L. Budd	*Horticulture and Gardening.*
A. A. Bennett	*Chemistry.*
B. D. Halsted	*Botany.*
D. S. Fairchild	*Hygiene and Physiology.*
Laura M. Saunderson	*Elocution.*

* "School Laws of Massachusetts. Supplement to the Edition of 1883, containing the Additional Legislation to the Close of the Legislative Session of 1885; issued by the State Board of Education."

The course of study is as follows:

FIRST YEAR.

First Term.	*Second Term.*
Domestic Economy.	Domestic Economy.
Botany.	Physiology and Hygiene.
Physical Training.	Dress-fitting and Millinery.
Household Accounts.	Essays.

SECOND YEAR.

First Term.	*Second Term.*
Domestic Economy.	Domestic Economy.
Chemistry.	Home Architecture.
Duties of the Nurse.	Home Sanitation.
Designing and Free-hand Drawing.	Home Æsthetics and Decorative Art.
Landscape and Floral Gardening.	Essays and Graduating Thesis.

Mrs. Ewing, dean of the school, thus states, clearly and powerfully, the reasons for its establishment and its purposes:

"This school is based upon the assumption that no industry is more important to human happiness than that which makes the home; and that a pleasant home is an essential element of broad culture, and one of the surest safeguards of morality and virtue. It was organized to meet the wants of pupils who desire a knowledge of the principles that underlie domestic economy, and the course of study is especially arranged to furnish women instruction in applied house-keeping and the arts and sciences relating thereto—to incite them to a faithful performance of the every-day duties of life, and to inspire them with a belief in the nobleness and dignity of a true womanhood.

"No calling requires for its perfect mastery a greater t of practice and theory combined than that of ic economy, and students, in addition to recitations and lectures on the various topics of the course, receive practical training in all branches of house-work, in the purchase and care of family supplies, and in general household management. They are not, however, required to perform a greater amount of labor than is necessary for the desired instruction.

"The course of study is for graduates of colleges and universities. It extends through two years, and leads to the degree of Master of Domestic Economy." *

The Le Moyne Normal Institute of Memphis, Tenn., is a private school, "sustained chiefly by benevolently disposed people at the North, for colored youth." In a letter to the author the principal of this school thus describes the manual features of its curriculum:

"Besides our Normal work proper, we give girls of the school two years' training in needle-work of different kinds, one year's instruction in choice and preparation of foods, with practice in an experimental kitchen, and six months' training in nursing or care of the sick. One hour a day is given to each of the foregoing subjects for the time indicated.

"I am about to erect workshops for training for our boys in the use of wood-working tools, and in iron-working and moulding—the course to comprise two years' time, two hours per day at the benches. We shall also have type-setting and printing as specialties for individual students. This work will be in operation in January, 1886." †

* Annual Catalogue of the Iowa Agricultural College.

† A. J. Steele.

The professor in charge of the Mechanical Engineering Department of the University of Michigan writes to the author as follows:

"There can be no doubt in the mind of a sane man that this practical instruction [laboratory work] is exactly what is needed by our engineering students. We are assured of that fact by the expression of gratification on the part of our engineering *alumni* to find here the very instruction which they were obliged to spend two or three years to secure after graduating. We give our students work of an elementary character for a few weeks, or until they become accustomed to tools, when we put them to work on some part of a machine. If they spoil it, well and good—it goes into the scrap-heap; if they succeed, they have the pleasure of seeing a perfect machine grow up under their eyes and hand. Students having matured minds, as most of ours have, work better with a definite plan in view. We always require them to work from drawings. Our course in forging is very popular; and it is especially useful, as it gives our young men that knowledge of the different kinds of iron and steel which will be of the greatest benefit to them as engineers." *

The National Educational Association of the United States, at its last meeting, at Saratoga Springs, N. Y. (1885), took a great step forward in the adoption of a resolution † endorsing the kindergarten. The association was, however, singularly illogical in its subsequent ac-

---

* Mortimer E. Cooley, Assistant Engineer, U. S. Navy.

† "*Resolved,* That we trust the time is near at hand when the true principles of the kindergarten will guide all elementary training, and when public sentiment and legislative enactment will incorporate the kindergarten into our public-school system."

tion, in voting to lay upon the table a resolution* recommending the introduction of manual training to the public schools. The kindergarten and manual training are one in principle, and should be one in practice. All educators will soon see this, and the National Educational Association will no doubt soon place itself as heartily on record in support of manual training as it has already done in support of the kindergarten.

Ohio ranks as the third State in the Union industrially, and she is making great strides in the direction of a more practical system of education. This is shown by the prominent place given to instruction in the mechanic arts in the State University at Columbus, by the prosperity of the Case School of Applied Science, and the introduction of manual training to the public-school system at Cleveland, and by the establishment of the Scott Manual Training School at Toledo. The city of Toledo owes the inception of the movement in support of the new education to the munificence of the late Jesup W. Scott, who during his life conveyed to trustees for purposes of industrial education, in connection with the public-school system, certain valuable real estate. After the death of Mr. Scott, his three sons,† still residents of Toledo, supplemented their father's donation with a sufficient sum of money to secure the erection and complete equipment of a manual training school for three hundred and fifty pupils.

The school is modelled after the schools of St. Louis and Chicago; but it gives only the manual side of the

* "*Resolved,* That we recognize the educational value of training the hand to skill in the use of tools, and recommend that provision be made, as far as practicable, for such training in public schools."

† William F., Frank J., and Maurice Scott.

curriculum, because it is conducted in connection with the public High School, receiving its pupils therefrom. It opened in the autumn of 1884 with sixty pupils, ten of whom were girls. Its register now numbers two hundred, fifty of whom are girls. Its course for boys is substantially the same as that of the Chicago school. The course for girls includes free-hand and mechanical drawing, designing, modelling, wood-carving, cutting, fitting, and making garments, and domestic science, including food preparation and household decoration. A distinguished lawyer and citizen of Toledo,* who has been prominent in the work of establishing the school, says,

"The brightest and most faithful pupils of the High School have eagerly availed themselves of the opportunity for manual instruction, and the zeal with which this new work is pursued has added a new charm to school life."

The school is in charge of Mr. Ralph Miller, B.S., who is assisted by Mr. Geo. S. Mills, B.S.† It is especially interesting, both as the newest educational enterprise and because it places the sexes on a footing of absolute equality. Reform in education must begin with woman, for it is from her that man inherits his notable traits, and from her that he receives the earliest and most enduring impressions. In the arms of the mother the infant mind rapidly unfolds. It is in the cradle, in the nursery, and at the fireside that the child becomes father of the man. The regeneration of the race through education must, then, begin with the child, and be directed by the mother; and this being the fact, the education of woman becomes far more imperative than that of man.

---

* Hon. A. E. Macomber.

† Graduates of the St. Louis Manual Training School, class of 1884.

That the ancients made so little progress in morals is due to the fact of their neglect of the education of woman. Neither in Egypt nor Persia was provision made for her mental or moral training. There were schools for boys in Greece, but none for girls; and not till late in the Empire was there any special culture for girls in Rome.

In the Middle Ages learning was confined to the religious orders. The narrow bounds of the convent contained all there was of science and art. In the castle and at the tournament woman ministered to man's pride and vanity; and in the peasant's hut, which was the abôde equally of poverty and ignorance, she endured both mental and moral starvation. Sir Walter Raleigh, Lord Bacon, Swift, Addison, Lord Chesterfield, Dr. Johnson, and Southey treated woman with mingled contempt and pity, and yet they were familiar with the story of Lucretia, of Virginia, and of the Maid of Orleans! But Shakespeare, with a sublimer genius, portrayed a Cordelia, a Desdemona, an Imogen, and a Queen Catharine, and with rare prevision of a future better than the age he knew, wrote these glowing lines:

> "Falsehood and cowardice
> Are things that women highly hold in hate."

This is the rational age, though not less truly chivalrous than that of Arthur and his knights; for, as Ruskin well says, "The buckling on of the knight's armor by his lady's hand is the type of an eternal truth—that the soul's armor is never well set to the heart unless a woman's hand has braced it." *

* "Sesame and Lilies," p. 97. By John Ruskin, LL.D. New York: John Wiley & Sons, 1884.

The distinguishing features of this time are its homes and its schools, and the purity of the one and the efficiency of the other depends upon woman. It was reserved for Froebel to rescue woman from the scorn of preceding ages by declaring her superior fitness for the office of teacher—the most exalted of civil functions.

The growth of the kindergarten has not been commensurate with its importance. Indifference and prejudice have united to discourage progress. Ancient contempt of childhood—that contempt which in Persia excluded the boy from the presence of his father until the fifth year of his age *—projects its sombre shadow down the ages. But manual training, which is the kindergarten in another form, is leading captive the imagination of the American people, and where the imagination leads, woman is in the van. Woman is to man what the poet is to the scientist, what Shakespeare was to Newton, the celestial guide. She tempts to deeds of heroism and self-sacrifice. She is less selfish than man, because a more vivid imagination inspires her with a deeper feeling of compassion for the misfortunes and follies of the race. Her intuitions are truer than those of man, her ideals higher, her sense of justice finer, and of duty stronger; and she has a better appreciation of the moral value of industry, remembering the temptations of her sex to evil through habits of idleness, enforced by the decrees of custom. And she is our teacher, whether we will or no—our teacher from the cradle to the grave—and it is through her ministry that we are destined to realize our highest mental and moral ideals.

This sketch of the history of manual training in the

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* "Herodotus," Clio I., p. 136.

United States is doubtless incomplete. It is, however, sufficient to show that the subject is already one of absorbing interest in all parts of the country.

Manual training in the public schools of Europe can scarcely be called educational, since the pupils usually make articles for household use. The purpose is purely industrial, and hence the mental culture received in the course of the manual exercise is the mere incident of a mechanical pursuit. But the making of things in the schools of Europe is gradually extending.

In Denmark an annual appropriation ($2000) is made by the Legislature for the encouragement of *slöjd* (hand-cunning) in the schools. All pupils in Danish and Swedish schools make things.

In Germany, Dr. Erasmus Schwab published in Vienna, in 1873, a book, "The Work School in the Common School." Rittmeister Claussen Von Kaas, of Denmark, travelled through Germany and delivered lectures on manual training, and now there is a considerable agitation of the subject.

In Finland all the country schools are *slöjd* schools.

In 1881 the Legislature of Norway appropriated $1250 for the support of *slöjd* in the schools.

In France a law (1882) makes manual training obligatory, and a school for training teachers—"Sécole Normale Superieure de travail Manuel"—in which there are about fifty students. Prof. G. Solicis is the chief supporter of manual training in France.

In Sweden, in 1876, there were eighty *slöjd* schools. In 1877 the number had increased to one hundred; in 1878, to one hundred and thirty; in 1879, to two hundred; in 1880, to three hundred; in 1881, to four hundred; and in 1882, to five hundred.

In Nääs, in Sweden, there is a seminary for the training of *slöjd* teachers.* Of this seminary Otto Salomon is director. In the *slöjd* schools small articles are made for use in the house, kitchen, on the farm, etc. The course of instruction embraces one hundred models. The materials for the first series of twenty-five models cost about 40 cents; for the second series of twenty-five the cost is 75 cents; and for the third series of fifty the cost is $3.25. The annual expense of the manual training in a Swedish country school is about ten to eleven dollars.

The technical and mechanic art or trade schools of Europe, generally, whether public or private, do not come within the scope of this work, since their purpose is industrial, not educational.

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* "Four young women have graduated from the Slöjd Teacher's Seminary at Nääs, Sweden, and two of them are now engaged in teaching manual arts."—Letter from John M. Ordway, A.M., Chair of Applied Chemistry and Biology, and Director of Manual Training, Tulane University of Louisiana.

INDEX.

A.

B.

C.

D.

E.

H.

L.

N.

O.

P.

R.

S.

T.

W.

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